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CONTENTS

APPLIED SCIENCES

Radar ECCM's New Area: Anti-Stealth and Anti-ARM (Li Nengjing; DIANZI XUEBAO, No 2, Mar 87)	1
Relaxation Effect of Stark Split Levels for Two-Level System Interacting With Symmetrical Strong Resonant Bichromatic Field (Yang Fuzi, Xu Yizhuang; GUANGXUE XUEBAO, No 3, Mar 87)	15
XeCl Excimer Laser Induced Multiphoton Ionization of Ammonia Molecule (Han Jingcheng, et al.; GUANGXUE XUEBAO, No 3, Mar 87)	16
Characteristics of Double Galvanometer Deflection System With Distortion Lens (Tang Wu; GUANGXUE XUEBAO, No 3, Mar 87)	18
Height Profile Inversion of Ionospheric Movement From Observed Parameters of HF Radio Echoes (Wan Weixing, Li Jun; KONGJIAN KEXUE XUEBAO, No 2, Apr 87)	19
Electrostatic Ion Cyclotron and Ion Acoustic Wave Instabilities Driven by Upgoing Oxygen Ion (O^+) Beams on Auroral Field Lines (Zhou Guocheng, Wang Deju; KONGJIAN KEXUE XUEBAO, No 2, Apr 87)	20
Method Estimating Integral Mean Value of Enhancement Factor and Path Latitude for Whistlers Below Magnetic Latitude 10° (Wang Youshan; KONGJIAN KEXUE XUEBAO, No 2, Apr 87)	21

Study of Dephosphorization in Powder Injection Process for High Chromium Stainless Steel (Zhang Shufan, et al.; GANGTIE, No 4, Apr 87)	22
New Teeming Technology for Rimmed Steel Ingot--The 'ZF' Process (Hu Lin, et al.; GANGTIE, No 4, Apr 87)	23
Tensile Strength and Deformation Behavior of Pearlite-Like Ferrite Plus Martensite Dual-Phase Steel (Sun Shuming, et al.; GANGTIE, No 4, Apr 87)	24
Thermomechanical Treatment of Supersaturated Solid Solution of LD-2 Aluminum Alloy (Zheng Yangzeng, et al.; JINSHU XUEBAO, No 2, 18 Apr 87)	25
Effect of Ti on Precipitation and Microstructural Parameters of Al-Zn-Mg Alloy (Lin Zhaoqi, et al.; JINSHU XUEBAO, No 2, 18 Apr 87)	26
Influence of Rare Earths on Mechanical Behavior and Solid-Liquid Coexisting Zone of Al-Cu Alloys During Solidification (Li Qingchun, et al.; JINSHU XUEBAO, No 2, 18 Apr 87)	27
Analysis of Passive Films of Al Alloys by XPS Depth Profile (Wang Danghan, et al.; JINSHU XUEBAO, No 2, 18 Apr 87) ...	28
Linear Minimum Variance Filter for Passive Localization (Wu Guoqing; SHENGXUE XUEBAO, No 3, May 87)	29
Measurement of Two-Dimensional Bottom Backscattering Coefficients at Shallow Water (Jin Guoliang, et al.; SHENGXUE XUEBAO, No 3, May 87)	30
Computation of Optimum Turbocfan Mixing With Subaccurate Varying Specific Heat Solution (Cui Jiya; GONGCHENG REWULI XUEBAO, No 2, May 87)	31
Three-Dimensional Calculation in High Subsonic Axial Compressor Rotor and Its Comparison With L2F Velocity Measurement (Wang Qinghuan, et al.; GONGCHENG REWULI XUEBAO, No 2, May 87)	32
Finite Element Analysis of Three-Dimensional Steady and Unsteady Temperature Fields (Computation of Temperature Distribution of Turbine Blade With Composite Cooling) (Ji Shouli, et al.; GONGCHENG REWULI XUEBAO, No 2, May 87)	33
Numerical Simulation of Flow Field in Reactor Producing TiO (Qin Chaobin, et al.; GONGCHENG REWULI XUEBAO, No 2, May 87)	34

LIFE SCIENCES

Studies of Analgesic Action and Physical Dependence of Bulleyaconitine A (Tang Xican; YAOXUE XUEBAO, No 12, 29 Dec 86)	35
Studies of Synthesis of Salicylamides and Alkamine Salts of Niclosamide and Their Activities Against <u>Schistosoma Japonicum</u> and <u>Oncomelania</u> (Zhang Zhaorui, Liu Yisun; YAOXUE XUEBAO, No 12, 29 Dec 86)	37
Genetic Variation of ADHI in Yeast <u>Saccharomyces Cerevisiae</u> (Wu Peipei, et al.; YICHUAN XUEBAO, No 1, 1987)	39
Induction of Endosperm Plants in <u>Lycium Chinense</u> Mill. Var. <u>Potaninii</u> (Pojark) A.M. Lu. and Examination on Chromosome Ploidy (Gu Shurong, et al.; YICHUAN XUEBAO, No 1, 1987)	41
Genetic Polymorphism of Fourth Component of Human Complement (C4) in Han Nationality of Wuhan District, China (Zhang Wenjie, et al.; YICHUAN XUEBAO, No 1, 1987)	43
Hb F Urumqi Gyl 22(B4)Asp → Gly: A New Fetal Hemoglobin Variant Found in Uygur Newborn Baby (Hu Huaiyu, et al.; YICHUAN XUEBAO, No 1, 1987)	45

NATIONAL DEVELOPMENTS

Standardization Goals for 1987 Outlined (ZHONGGUO BIAOZHUNHUA, No 3, 5 Mar 87)	46
Science, Technology Personnel Issues in Shanghai Discussed (Qian Zhenmeng; KEXUEXUE YU KEXUE JISHU GUANLI, No 2, Feb 87)	51
Analysis Provided for Status Quo on S&T Production Gulf (Guo Qinghan, Liu Zhonghe; KEJI RIBAO, 19 Feb 87)	58
University S&T Joint Research Center Founded (Sun Shuxing; KEJI RIBAO, 11 Feb 87)	62
CAS Joins in Founding Joint Research Laboratory (Du Mingming, Zhang Fengsha; KEJI RIBAO, 15 Feb 87)	63
Impact of Allocation Changes on Research Units Reviewed (Yu Jing; KEJI RIBAO, 31 Mar 87)	65
Lease, Joint-Stock System for Research Institutes Suggested (Ma Xiliang, Hou Yuanzhi; KEXUEXUE YU KEXUE JISHU GUANLI, No 2, Feb 87)	67

Branch Academy Actively Supports Continuing S&T Education (Deng Xianchun; KEJI RIBAO, 21 Feb 87)	71
Technology Import Company To Get Into Technology Exports (GUOJI MAOYI, 3 Feb 87)	73
Efforts Noted for Increasing Technology Exports (Chen Xiaoling; KEJI RIBAO, 30 Mar 87)	75
Success in Overseas Contracted Labor Market Reported (RENMIN RIBAO OVERSEAS EDITION, 23 Feb 87)	77
Effects of New S&T Restructuring Policies Explored (Han Yuqi, Li Renqin; KEJI RIBAO, 30 Mar 87)	78
Success of S&T Development Company Described (Ji Hongguang; KEJI RIBAO, 30 Mar 87)	82
Incorporation of S&T Units Into Enterprises Discussed (Ji Hongguang; KEJI RIBAO, 12 Feb 87)	84
Explanation of S&T Achievement Awards Policies (KEJI RIBAO, 12 Feb 87)	87
Song Jian Discusses Developing Rural Economy (Song Jian; KEJI RIBAO, 22 Feb 87)	90
Review of Reasons for Success in Haidian S&T Community (Zheng Haining, Tang Shifen; KEJI RIBAO, 19 Feb 87)	97
Emergence of Civilian S&T Industrialists Lauded (Tang Shifen, Zheng Haining; KEJI RIBAO, 11 Feb 87)	103
Efforts Described for Invigorating Electromechanics (Li Jiakang; ZHONGGUO JIXIE BAO, 10 Feb 87)	105
Contributions of Mineral Deposit Institute Reviewed (Feng Zai, Chen Hui; KEJI RIBAO, 30 Mar 87)	110
Discovery Made in Superconductor Research (Zhang Zhaojun, Tong Yu; KEJI RIBAO, 29 Mar 87)	112
World's First Plastic Battery Developed (RENMIN RIBAO OVERSEAS EDITION, 21 Apr 87)	113
Developments in Gas Turbine Applications Noted (Huang Bin; RENMIN RIBAO OVERSEAS EDITION, 23 Feb 87) ...	114
Interview With Planetary Wave Kinetics Theoretician (Zhou Qing; RENMIN RIBAO, 12 Apr 87)	116

PHYSICAL SCIENCES

Determination of Gross- β Radioactivity in Water of Changjiang River and Seawater Near Its Entrance to Sea (Kang Xinglun, et al.; HAIYANG YU HUZAO, No 2, Mar 87)	118
Flow Injection Analysis of Iron in Marine Sediments (Yuan Youxian; HAIYANG YU HUZAO, No 2, Mar 87)	119
Geomorphology and Sedimentation in Coastal Zones From Chengshanjiao to Shihao, Rongcheng, Shandong Province (Li Congxian, et al.; HAIYANG YU HUZAO, No 2, Mar 87) ...	121

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RADAR ECCM'S NEW AREA: ANTI-STEALTH AND ANTI-ARM

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 2,
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[Article by Li Nengjing [6786 5174 2417]]

[Text] I. Background

The threat of electronic jamming to military radar is a well-known fact[1]. But in future warfare, the radar will encounter two other serious threats: i.e., stealth technology and anti-radar missiles (ARM). Like electronic jamming, stealth technology is a "soft" countermeasure which is designed to confuse the radar; the effect is enhanced when both are used simultaneously. ARM on the other hand, is a "hard" countermeasure which destroys the radar; it can be used in conjunction with other air-to-surface offensive measures such as bombers.

The United States and the Soviet Union began research on stealth technology and anti-radar missiles in the 1950's. In the 1960's, the United States started using wave-absorbing coating on the U-2 and P2V-7 reconnaissance aircraft to reduce radar backscattering; also during the Vietnam war, the first-generation ARM, the "Shrike" missile, was used numerous times. In the early 1980's, major breakthroughs were made in stealth technology; the U.S. arsenal acquired the B-1B stealth bomber, stealth cruise missiles and miniature stealth RPV's. It is predicted that by the end of the 1980's, the United States will have 10 percent of its military aircraft using stealth technology. ARM's have already advanced to the third generation in the United States--called the HARM missile; its targets include not only the fire-control and tracking radars, but also search and warning radars and air traffic control radars.

On the subject of aircraft stealth technology, a number of good illustrative articles have already appeared in this country[2]. Stealth technology by definition should include all measures designed to reduce the detectability of aircraft, but the emphasis is on radar backscattering and infrared radiation. Here, we shall present a brief summary of aircraft anti-radar stealth technology.

1. Shaping Techniques for Reducing Radar Cross-Section (RCS)

These include: a) Replacing backscattering shapes by non-backscattering shapes such as sharp nose cones, delta wings, inverted V tails, and inclined or S-shaped engine intakes. b) Eliminating profiles which produce the effects of mirror reflection or corner reflectors by using integrated fuselage-wing design, arc-shaped wings, and replacing vertical tails by inclined double tails. c) Minimizing scattering sources by using fully embedded or semi-embedded engine designs, flying wing configuration, removing appendages, and shielding one part by another. Based on information reported in foreign literature and simulation test results conducted in this country, the RCS of an aircraft can be reduced by 10 dB or more using shaping techniques. Figures 1-3 show the shapes of several representative low-RCS aircraft.

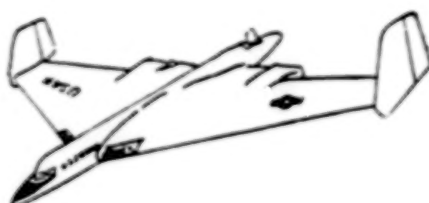


Figure 1. Illustration of the Stealth Bomber ATB

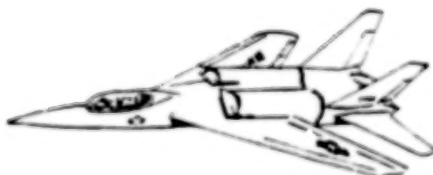


Figure 2. Illustration of the Boeing ATF Design

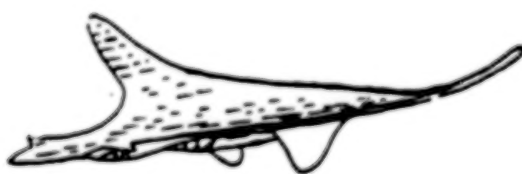


Figure 3. Illustration of a Stealth Aircraft With Arc-Shaped Wing Design

2. Wave-Absorbing Surface Coating

The early application of parasitic surface coating with uniform thickness could produce a 10 dB attenuation, but the frequency band was only 20 percent. Today, the thin-film ferrite coating and the mixed ferrite and synthetic rubber coating developed by the United States and Japan can achieve 20-30 dB attenuation and a bandwidth of 5-10 GHz. Another type of isotope curium and polonium coating which is currently under study uses radioactive α particle

rays to ionize the air at the surface of the aircraft and form a layer of plasma to absorb electromagnetic waves; this technique can achieve more than 10 dB attenuation in a wider frequency band (1-20 GHz).

3. Use of Wave-Absorbing Materials for Aircraft Structures

They include composite structural materials made of wave-absorbing materials and transparent non-metallic materials, as well as those made of wave-absorbing materials and resin reinforced with metallic and non-metallic fibers. These materials can produce more than 10 dB attenuation in the centimeter band.

Also, by using non-conducting, transparent materials such as fiberglass-reinforced resin to replace the metallic materials, the backscattering of the aircraft can be reduced by approximately 10 dB.

4. Use of Impedance Loading Technique

This involves cutting a groove on the surface of the aircraft and connecting to a cavity or integrated parameter impedance load. When the scattering field of the aircraft and the scattering field of the load impedance are equal in amplitude and opposite in phase, a near-zero scattering field can be obtained in a particular far-field direction. In other words, the scattering cross-section of the aircraft in this direction is significantly reduced. The impedance loading technique is most effective when the dimensions of the aircraft are in the resonant region of electromagnetic spectrum or the lower end of the optical region. At these wave lengths, most shaping techniques and wave-absorbing coating techniques are no longer effective.

On the subject of anti-radar missiles, a few illustrative articles have also appeared in this country^[2,4,5]. Here, we shall give a brief introduction on this subject.

1. In general, an ARM uses the emission of its target radar as a source for search and guidance. Future ARM's may use in addition the parasitic electromagnetic emission and thermal radiation of the radar station as the search source.

2. In guiding itself toward the target radar, an ARM must go through the processes of search, acquisition, locking and tracking the radar signal. Search and acquisition are generally performed under the control of the onboard radar warning system (RWS). By locking on the target signal, the homing device can follow the designated signal without being disturbed by other radar transmissions. Locking is generally accomplished by using selective circuits or gate circuits to recognize the carrier frequency or repetition frequency, the direction or time of arrival, and amplitude of the signal. During the launch preparation stage, the homing device first locks on the target signal, and continues to track the signal after launch. If the target signal is lost during flight, then the homing device switches from the tracking state to the search state until the target is re-acquired.

3. In recent years, significant progress has been made in guidance technology. First, the frequency coverage has been extended. The first-generation U.S. "Shrike" missile used 13 different homing devices to cover the L-K frequency band, the second-generation "Standard" missile only required 2 homing devices, and the third-generation "HARM" missile only requires one homing device. Second, the sensitivity of the homing device has been improved; it can not only acquire the main lobe of a radar antenna, but also the side lobe or back lobe. This implies that ARM's can attack not only fire-control radars but also warning and tracking radars, traffic control radars, weather radars. Third, by using microprocessor control, the homing device can be pre-programmed to perform active target search and acquisition; also, the system can accommodate any new threats simply by modifying the software. The "HARM" missile is equipped with this type of homing device. Fourth, by installing an inertial reference unit (e.g., on the "HARM" missile) or a memory unit (e.g., on the "Standard" missile), an ARM can remember its target after it has been tracked for a certain period, and thus automatically re-acquire the target even though it has been lost.

II. Anti-Stealth Measures

Anti-stealth measures can be divided into two main categories: 1) countering stealth techniques by preventing the RCS of the aircraft from reaching the expected low level; 2) increasing the radar detection capability so that the reduced RCS of an aircraft can still be detected. In actual implementation, these two measures are often used in concert with one another.

Category I. Preventing the Aircraft RCS From Reaching the Expected Low Level

(1) By Selecting a Lower Radar Carrier Frequency. This is an effective measure for countering the low-RCS shaped design. D. Moratis et al. of the Hughes Co. discussed this issue in a paper presented at the 1985 International Radar Conference in Washington (RADAR-85)[6]. It was pointed out that aircraft with low-RCS designs generally have a low backscatter sharp conic or rhombic nose configuration (see Figure 1) whose RCS varies with frequency. In the optical region and resonant region, the RCS of a cone is proportional to the square of the wavelength; the RCS of a rhomb is linearly proportional to the wavelength. For example, the detection ranges of these targets at S-band (3,000 MHz) can increase by a factor of 2.5 and 1.6 respectively if the carrier frequency were reduced to the UHF range (500 MHz). At meter band (150 MHz), they can be increased by a factor of 4.5 and 2.1 respectively (see Figure 4).

The use of meter-waves and UHF also has a negative effect on absorption coating. The effective frequency band of today's absorption coating layer only occupies a small segment of the 1-20 GHz band; even in the future, it is not expected to cover the meter band. This is not only due to the frequency characteristics of the coating material, but also because the required thickness of the coating layer must be approximately $1/4$ to $1/10$ of the wavelength[7]. At the meter band or UHF band, the required coating thickness would be several tens of centimeters, which is clearly unacceptable. Furthermore, the attenuation effect of the absorption composite materials

used in stealth applications are significantly reduced at the meter band or UHF band due to limitations in the frequency response.

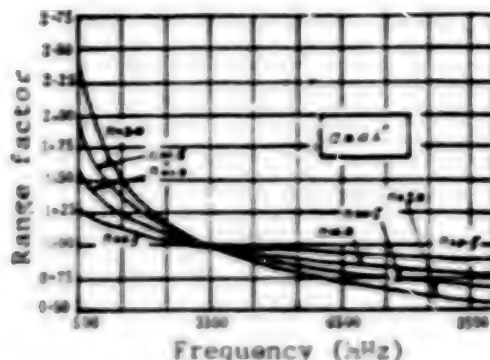


Figure 4. Free Space Range Factor of Targets With Shaped Designs (reference to the S-band) (σ is the target RCS, a is a constant, and n is the power factor)

From the anti-stealth point of view, the meter-wave and UHF radars which were widely used in the 1940's will again play an important role in the future as search radars and long-range warning radars. At the 1984 International Radar Conference (ICR-84) in Paris, Dorey Jacques et al. of France proposed a new "RIAS" design for air-defense warning radars[8]; they suggested the use of meter waves, and the use of large, sparse arrays and pulse compression technique to solve the resolution problem. The new phased-array warning radar "FSAR" developed jointly by the Westinghouse Co. and the Naval Research Laboratory[9] also use the UHF band. In RADAR-85, A. Farina et al. of Italy presented an overview of the signal processing techniques for surveillance radars; it had one section devoted to the discussion of anti-stealth techniques, where they listed the use of meter band as the top anti-stealth measure.

An even more effective anti-stealth measure is to use the HF band which is lower than the meter band. In this band, stealth techniques such as low-RCS shaping, absorption coating, and impedance loading all become ineffective; also, the RCS of conventional aircraft in this band would be 1-2 orders of magnitude higher than that in the microwave band[11]. But at present, HF transmissions have been used successfully only in over-the-horizon radars which rely on ionospheric reflections. In the future, the HF band will also rely on the propagation of ground waves to detect over-the-horizon targets such as low-flying aircraft and surface ships.

(2) By Using a Bistatic (or Multistatic) Radar System. In a bistatic radar system, the transmitting and receiving stations are separated by a distance D_b . The magnitude of D_b is of the same order as the distance between the transmitter and the target D_t or the distance between the receiver and the target D_r . The subtended angle β between D_t and D_r is the scatter angle of the target (see Figure 5). A multistatic system consists of two or more receiving stations.



Figure 5. Illustration of a Bistatic Radar System

Under certain conditions, a bistatic (or multistatic) radar can suppress or negate the effects of stealth measures for the following reasons:

(1) Under certain conditions, an aircraft with low-RCS design will produce a larger RCS when observed by a bistatic radar.

For $\beta \neq 180^\circ$, the bistatic RCS σ_b of a complex object can be obtained from the "Bistatic Theorem"[12]: "The bistatic RCS of a smooth object illuminated by a short-wave electromagnetic emission from the direction \hat{k} and received in the direction \hat{n}_0 , is equal to the monostatic RCS with simultaneous illumination and reception in the direction $\hat{k} + \hat{n}_0$." The required conditions for this theorem such as "smooth object," "short wavelength," are not very strict. It has been reported that test results using a 250-MHz radar on a B-47 aircraft are still in good agreement with this theorem[12]. Therefore, by transmitting in the direction of the nose of the aircraft and receiving in a direction separated by the angle β , the bistatic RCS of the aircraft is equal to the monostatic RCS of the aircraft in the direction $\beta/2$ from the nose. Generally, an aircraft with low-scatter design has the smallest monostatic RCS in the nose direction; the RCS is significantly enhanced when viewed from the side, the bottom, or the top. Thus, the bistatic RCS $\sigma_b(\beta)$ in these directions is much larger than the low RCS value $\sigma_n(0)$ in the nose direction when β is sufficiently large.

When $\beta = 180^\circ$, one enters the "forward scatter region," and the "Bistatic Theorem" no longer applies. The formula for the forward scatter RCS is given by: $\sigma_f = 4\pi A^2/\lambda^2$, where A is the geometric cross-sectional area of the object. When λ is smaller than the dimensions of the object, σ_f may become very large.

In actual applications, the possibility of using forward scatter to produce large RCS is quite limited. Currently, the primary use of bistatic radar is to apply the bistatic theorem to achieve large RCS of an aircraft in a direction away from the nose. Therefore, in applying this technique, the direction of transmission and the direction of reception should be chosen in such a way that the resultant angle is pointed in a direction where the monostatic RCS is significantly enhanced. In other words, the bistatic angle β should be as large as possible.

The deployment of a bistatic radar system on the ground is subject to many restrictions. For example: a) For an aircraft far away from the protected

region, it is difficult to achieve $\beta > 90^\circ$. b) It is not possible to have a resultant angle pointed at the rear of the aircraft, where the RCS is generally larger, as illustrated in Figure 1. This restriction can be overcome by using an airborne bistatic (or multistatic) radar system to detect a low-flying aircraft. In 1980, the United States successfully developed the "Sanctuary" plan, which was primarily based on an airborne bistatic radar system[13]. If the transmitting station can be installed on a geosynchronous satellite in space, then both restrictions a) and b) can be overcome. Such a space-borne radar system was proposed by P.K. Lee of the United States in a paper presented at the RADAR-85 conference[14]--by placing it on a geosynchronous satellite 22,300 miles above the earth, and using solar energy as its power source. The main advantage of this system is that the antenna aperture (65-ft diameter at S-band) and the transmitter power (27 kW) are much smaller than those of a monostatic ground-based system, and the ground-based or airborne receiving segments can be concealed to avoid jamming or attack. P.K. Lee predicted that this type of radar would be in the development stage by the 1990's, and is expected to be deployed by the year 2000.

(ii) Under bistatic observation, the effect of wave-absorption coating is reduced. It was pointed out by Bachman[7] that when a wave intercepts an absorbing material normally, the reflection is attenuated by 25 dB; when the intercept angle is 30° , the attenuation is only 18 dB; when the intercept angle is 70° , the attenuation is reduced to only 5 dB. With bistatic observation, the attenuation is even less. When β approaches 180° , i.e., near the forward scatter region, the RCS of a coated object is almost unattenuated.

(iii) The impedance loading technique is also effective in suppressing backscatter only in the normal direction and within a small angle from normal; in other directions, the backscatter is intensified. Therefore, with bistatic observation and relatively large β angle, the RCS is actually enhanced.

(3) By Using a Netted Radar System. Such a system allows some radars to observe an aircraft from the side, from the back or from below. The basic principle of this anti-stealth technique is similar to that of a bistatic system.

In RADAR-82[15], J. Marshall et al. proposed the concept of a "radar fence" by using a low-power, unmanned radar with a vertical fan beam to monitor targets passing overhead, and automatically sending the data to the control center. Such a radar fence should be deployed along the boundary of the protected zone or along the national border. Clearly, they are primarily designed to detect targets from below.

(4) By Using Very Wide Bandwidth Radar Signals Such as Impulse Signals. In a paper presented at the RADAR-85 conference, G.M. Hussain[16] pointed out that the absorption coating technique is totally ineffective against impulse signals in the 0.5 GHz-10 GHz range. How to use these signals on a radar to detect long-range targets is currently being studied.

Category II. Increasing the Detection Capability Against Reduced-RCS Targets

- (1) Increasing the Power Aperture (PA) Product of the Radar. This approach is unattractive because the cost increases proportionally with PA.
- (2) Increasing the Pulse Number for Coherent Processing. In the Inverse Synthetic Aperture Radar (ISAR) technique, the return pulses of a certain segment of the target motion are coherently integrated after phase compensation. For a search radar, the penalty associated with this technique is that the time required to cover a given search space would be increased.
- (3) Using a Multistatic System. This is a "space diversity" technique where a large number of receiving stations are deployed so that multiple target observations can be made over a wide angular range, and target detection is accomplished by using the total amount of scatter energy.
- (4) Adaptive Reception. In order to accommodate stealth targets with RCS less than 10^{-3} m^2 and conventional targets of different sizes ($\text{RCS} = 1\text{-}10^2 \text{ m}^2$), the radar receiver and signal processor must have a wide dynamic range. The improvement factor of the Doppler filter must be 60 dB or higher. The radar recorder must be able to filter out a large number of moving targets whose RCS are of the same order magnitude as the stealth targets, e.g., birds, insects and atmospheric phenomena[10].
- (5) Exploiting the Polarization Characteristics of the Target[17]. The polarization characteristics of an aircraft is highly complicated; incident waves with different polarizations can cause significant changes in the RCS, and the polarization of the backscatter is usually different from that of the incident wave. In the case of a rhombic configuration which is often used in stealth aircraft design, the intensity of the backscatter is closely correlated with whether or not the incident polarization is parallel to the side of the rhomb. Therefore, the polarization characteristics of a stealth target may be more pronounced than that of a conventional target. If the radar has the capability to change its transmitting polarization, then it can adapt to the polarization characteristics of the stealth target to maximize the backscatter; the receiving system can detect the returns of both polarizations, and combine them optimally to maintain maximum radar detection capability.
- (6) Techniques for Detecting Weak, Unknown Signals. The techniques currently under development include: a) Detection of the extreme points of the transient inverse scatter field. The low RCS of a stealth aircraft occurs only in the steady-state inverse scatter field; at the extreme points of a transient field, the intensity is much higher. b) Detection of the harmonic components of the target scatter[18]. The backscatters of all man-made targets have harmonic components; these components are not affected by the use of stealth techniques which only reduce the baseband RCS. Therefore, one way to enhance the detectability is to intercept the harmonic components.

III. Anti-ARM Techniques

Anti-ARM measures can be divided into three categories.

Category I. Making It Difficult for the Onboard Homing Device of the ARM To Intercept and Track the Radar Signal

(1) Using Low Probability Intercept (LPI) Techniques^[19]. LPI techniques include:

- (a) Carrier frequency hopping.
- (b) Repetition frequency hopping.

These measures will make it difficult for the ARM's surveillance system to separate and discriminate the radar signal.

(c) Super-low sidelobe antennas. This will prevent the ARM from intercepting and tracking sidelobe emissions of the radar. The mainlobe of a surveillance radar is very narrow. For a three-coordinate radar with one-dimensional phase scan (or frequency scan), the dwell time of the mainlobe at each beam position during the scan is very short--only several (or just one) pulse periods. Therefore, the duty factor of the mainlobe radar signal received by the ARM is extremely small, making it almost impossible to track the mainlobe signal. But sidelobe signals at high elevation angles have rather large duty factors, and they are the primary ARM targets. For this reason, the sidelobe level of a surveillance radar with elevation angle greater than 45° is required to be less than -50 dB. Since sidelobe suppression is one of the basic anti-jamming measures, super-low sidelobe antenna is a common feature of new radars developed in the 1980's. The maximum relative sidelobe levels of the U.S. 3-D radar AN/TPS-70 and the British S-723 radar are less than -40 to -45 dB.

(d) Use of large time interval, large bandwidth signal with variable waveforms. When the surveillance system of an ARM has no precise knowledge of the signal waveform, it can only use unmatched amplitude detection and non-coherent detection. In this case, the signal processing gain will be reduced by a factor of $(BT_0)^{1/2}$ [19] where B and T_0 are respectively the bandwidth and time interval of the radar signal; i.e., the detection range of the ARM would be reduced by a factor of $(BT_0)^{1/4}$.

The above LPI techniques have been used on two new short-range search radars developed by the Hughes Co. One is the TWS QR (Track While Scan Quiescent Radar)^[20]; its antenna has a sharp, electronically-scanned mainlobe and extremely low sidelobes; the transmitted waveform is a continuous wave with pseudo-noise modulation. The other is the Flexar (Flexible Adaptive Radar)^[21], which has 1,400 different variable waveforms.

It should be pointed out that one of the LPI measures is to reduce the maximum detection range R_{\max} of a radar. Theoretically, a radar with large R_{\max} can be replaced by a network of small- R_{\max} radars. In practice, when one

considers the matching requirement between the radar and the weapon system and the anti-stealth requirement, it is difficult to reduce the R_{\max} based on LPI considerations.

(2) Using Bistatic (Multistatic) Radar System. In this case, the ARM cannot attack the receiving stations because they do not radiate; the transmitting station can be deployed at a location which is difficult to detect or attack.

(3) Radar Transmission Control. It includes the following: a) Intermittent or scintillating transmission, where the duty cycle is so low that it is difficult for the ARM to maintain track. The U.S. AN/SPY-1A phased-array radar of the ship-borne "ZEUS" air defense system uses this mode of operation. The AN/MPQ-53 phased-array radar of the "PATRIOT" air defense missile system also uses this type of anti-ARM transmission control system, where the time and magnitude of transmission can be controlled. b) Capability to suppress transmission in certain azimuth direction or to have several "quiescent fan regions." Almost all the 3-D search radars developed in the United States or Europe after the 1970's have this control capability. c) Emergency shut-off. The transmission is immediately turned off upon detection of an ARM. The new-generation search radars and fire-control radars are all equipped with this control device. The low-altitude search radar "Watchman" built by the British Plessey Co. uses this technique as an anti-ARM measure[22]. d) "Snap-shoot" approach. In this mode of operation, only one fire-control radar of the defense network is activated to acquire and track the target; the other fire-control radars in other defense units follow the targets passively based on the trajectory parameters provided by the command center. Once the target enters the firing range of a particular defense unit, the radar is suddenly activated and defensive action is immediately taken. e) Use of other emissions in place of radar transmissions. During the period when the radar is inactive, the enemy aircraft can be monitored and tracked by using visible light, infrared rays and jamming signals emitted by the aircraft. Almost all the new-generation fire-control radars have visible-light or infrared auxiliary tracking systems. For example, both the Swedish 9LV200 system and the U.S. ADATS system have television tracking, infrared angle tracking and laser ranging capabilities; the Swiss "Skyguard" system has television tracking and laser ranging capabilities.

(4) Radar Mobility. In an ARM system, the search for target radars is based on deployment information of enemy radars provided by electronic intelligence (ELINT) or electronic surveillance activities. On 9 June 1983, Israel used ARM's to attack 19 Syrian SA-6 missile sites located in the Bekaa Valley; the success of this attack was attributed to the acquisition of complete information of the Syrian deployment scenario from electronic surveillance, and the failure by Syrian military to change the deployment. The new-generation radars including short-range search radars and fire-control radars have a high degree of mobility; they can be installed or dismantled in minutes. Even the long-range surveillance radars such as the U.S. AN/TPS-59 and the British S-713 and S-723 are designed to be installed and dismantled in 1-2 hours.

(5) The Use of Meter-Band and UHF Band. Because of the diameter constraint of an ARM, its homing device cannot have a large-aperture antenna. In order to search and track a target radar, the antenna aperture generally should be larger than 1 wavelength. The maximum diameter of U.S. and European ARM's is about 40 cm; hence it would be difficult to handle radars operating below 1 GHz. The maximum diameter of long-range Soviet ARM's is reported to be 1 m, hence it will have difficulty handling meter-wave radars. Therefore, a possible trend in the future is to use meter waves for search radars and UHF for tracking radars.

Category II. Jamming the ARM Homing Device and Preventing the ARM From Hitting the Target Radar

(1) Deployment of Active Anti-ARM Decoys^[23]. It was pointed out earlier that prior to track initiation, an ARM first uses gate circuits to lock on the target based on information of its frequency and its direction and time of arrival (sometimes also repetition frequency). In order to attract the ARM's, anti-ARM decoys must have these same characteristics as the radar, and its effective power (the product of transmitted power and antenna gain) must be higher than the sidelobe level of the radar. Therefore, a radar decoy must satisfy the following conditions: a) It must be located sufficiently close to the radar, as long as it is beyond the range of destruction of the ARM, e.g., 100-300 m. From the launch point of the ARM (generally more than 10 km from the target), the subtended angle between the radar and the decoy must be smaller than the angular resolution of the homing device (e.g., for the Shrike missile, it is 8°). b) The transmitting frequency of the decoy must be very close to that of the radar signal, so that it cannot be frequency-discriminated by the homing device. c) If the homing device of the ARM has a selective circuit for signal repetition frequency, then the repetition frequency of the decoy transmission must be synchronized with that of the radar signal. It is desirable to have the decoy pulses slightly ahead of the radar pulses (0.1-0.2 μ s) so that the homing device will lock on the decoy pulses. In view of the above requirements, the decoy is generally designed to extract part of the power from the radar, or to amplify the radar signal before re-transmission; in this case, the transmitted signals of the decoy and the radar not only share the same frequency, but are also synchronized and coherent.

(2) Use of Netted Radars or Dispersed Radars^[24,25]. To jam mainlobe tracking by the ARM requires the use of netted operation of more than two radars. An effective radar net is to have the radars deployed in a dispersed configuration. The frequency of each radar is fixed, and the transmission times of the pulses are synchronized; the time delay of the transmission trigger can be adjusted so that the transmitted signals of these radars have maximum overlap in the expected search space. In order to avoid interference between the radars, the transmitted signal of each radar is coded; the coded waveforms are uncorrelated with one another, and they have very good autocorrelation pulse compression characteristics. The amplitude and phase of the overlapped signals change continuously, which is equivalent to injecting white noise into the ARM homing device; as a result, the tracking performance of the homing device is degraded or lost.

In a dispersed radar net, the transmitting system and the receiving system are separated by several hundred meters, so that the receiving system is not threatened by the ARM. The transmitting system generally consists of 2 or 3 identical transmitters and antennas separated by 200-300 m; furthermore, they operate at the same power level, same frequency, and are phased-locked and synchronized to form an integrated search and track beam. The ARM would only track and hit the center of energy of the radar net, which is usually the geometric center; thus the individual radars can escape destruction.

(3) Use of Intermittent Transmission To Interfere With the Servo System of the ARM. The intermittent transmission period of a radar is generally of the same order of magnitude as the damped oscillation of the ARM servo system; its duty factor is of the order of 0.5. Thus, it can interfere with the servo system's ability to guide the missile. A simple intermittent operating mode will degrade the radar performance. A more complicated mode involves two channels operating at two different frequency bands. Initially, only one channel is activated to perform target search and track; once an attacking ARM is detected, it switches into two-channel operation. Thus, while the ARM initially locked onto the first signal, now it only receives an intermittent signal.

Category III. Detecting ARM Launches

This measure is now being used by many radar systems. For example, the Swiss-built "Skyguard" fire-control system has an ARM warning circuit which can discriminate the ARM returns based on its high radial velocity, and issue a warning. Then the antenna will be automatically steered to track the returns, and a defensive missile will be launched to intercept the ARM.

However, detecting ARM launches is difficult for a low-data-rate, short-range search radar. The U.S. Air Force^[26] has reportedly developed a special-purpose ARM warning sensor for its AN/TPS-43E 3-D radar. This is a low power, solidified pulse Doppler radar with an electrically scanned antenna; it is low cost and easy to transport. The sensor is installed near the TPS-43E radar and connected to it by electric cables, but it operates at a different frequency band. Upon detecting any incoming ARM, it can immediately turn off the TPS-43E radar.

It should also be pointed out that the fundamental approach to anti-ARM is to study the guidance technique of the enemy ARM. In a paper "ARM Simulation Model"^[5], J. Barbow et al. said: "Based on recent ARM simulation results, it can be stated that a group of ARM parameters can always be chosen to overcome any known countermeasures; on the other hand, a countermeasure can also be designed to overcome any known ARM."

IV. Concluding Remarks

While stealth technology and anti-radar missiles will become major threats to military radars, many countermeasures are also being developed. The commonly used countermeasures against these two threats are: the use of bistatic (or multistatic) systems and low carrier frequencies. Some

techniques are also effective against electronic jamming, e.g., low probability intercept techniques (including super-low sidelobe antenna, frequency hopping, flexible and variable coded signals), bistatic (multistatic) systems, weak signal detection and high radar mobility. Clearly, these techniques should be the focal point for current radar research.

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3012/6091

CSO: 4008/46

RELAXATION EFFECT OF STARK SPLIT LEVELS FOR TWO-LEVEL SYSTEM INTERACTING WITH SYMMETRICAL STRONG RESONANT BICHROMATIC FIELD

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 3, Mar 87
pp 193-199

[English abstract of article by Yang Fuzi [2799 0265 1311] of the Department of Applied Physics, Shanghai Jiaotong University; Xu Yizhuang [1776 0076 5369] of the Department of Physics, Qinghua University]

[Text] Using the semi-classical theory, density matrix method and probe-field approximation and taking into account the relaxation effect, the authors have investigated the Stark split phenomenon for a two-level system interacting with a strong resonant bichromatic field. In the case in which two strong fields have the same amplitude and symmetrical detuning of frequency, the relaxation effect not only influences the weight of the split levels created from the optical Stark effect and broadens these levels, but also the new split levels can be found in a new position. It is predicted that new satellite lines of spectra can be observed in the optical spectrum. These results differ considerably from those for a monochromatic field and previous work on the bichromatic field which did not take relaxation into consideration. In the case of the monochromatic field, the relaxation effect influences the weight and width of the Stark split levels, but no new split levels can be found. Since the relaxation effect produced by spontaneous emission between the upper and lower levels in a real atom and molecule system usually cannot be neglected, the results described in this paper can be used in practical applications. (Received 28 Apr 86; revised 2 Jul 86.)

9717

CSO: 4009/58

XeCl EXCIMER LASER INDUCED MULTIPHOTON IONIZATION OF AMMONIA MOLECULE

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 3, Mar 87
pp 216-222

[English abstract of article by Han Jingcheng [7281 2529 6134], et al., of the Laboratory of Laser Spectroscopy, Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei; Zhu Rong [2612 2837], et al., of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] XeCl excimer laser induced multiphoton ionization and fragmentation of NH_3 are investigated using a molecule-beam apparatus and modified quadrupole mass spectrometer. The authors observed two mass peaks due to NH_2^+ and NH_3^+ at $m/e = 16$ and 17, and also found a very strong mass peak of NH_4^+ at $m/e = 18$. The yield dependences for various ions on the parent molecular pressure and laser power were measured in order to have a better understanding of the generation mechanism for various ions, particularly the NH_4^+ ion.

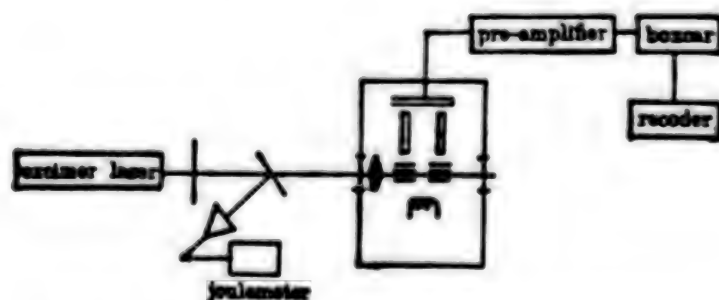


Fig. 1 Schematic diagram of the experimental apparatus

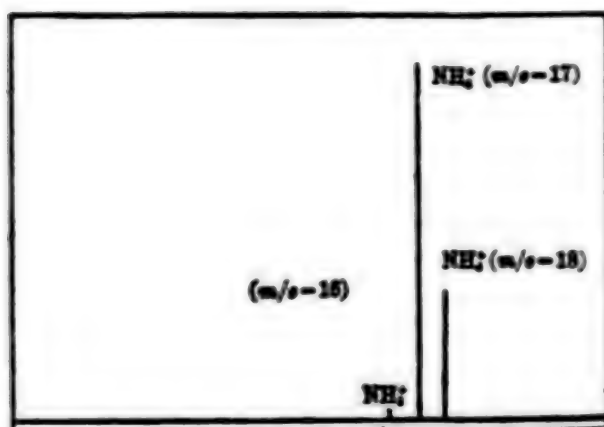


Fig. 2 Multiphoton ionization mass spectra for NH_3 .

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CHARACTERISTICS OF DOUBLE GALVANOMETER DEFLECTION SYSTEM WITH DISTORTION LENS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 3, Mar 87
pp 261-268

[English abstract of article by Tang Wu [0781 2976] of Shanghai Institute of
Laser Technology]

[Text] In this paper the basic formula for a double galvanometer deflection system with a distortion lens is given. Various distortion equations and distortion error formulas, and the adjusting method and adjusting error formula are described. The characteristic relationships regarding the constant ratio and constant error-difference for the system are deduced. These relationships are consistent with experimental results obtained from a large screen display. Finally, a linear scanning scheme, distortion-free on a plane screen, is discussed. (Received 23 May 86; revised 26 Jul 86.)

9717

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HEIGHT PROFILE INVERSION OF IONOSPHERIC MOVEMENT FROM OBSERVED PARAMETERS OF HF RADIO ECHOES

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese
Vol 7 No 2, Apr 87 pp 85-94

[English abstract of article by Wan Weixing [8001 5898 2502] and Li Jun [2621 6874] of Wuhan Institute of Physics, Chinese Academy of Sciences]

[Text] Under conditions of an unstable, inhomogeneous and anisotropic ionosphere, some relationships among the dynamic parameters of the ionosphere and observations of HF radio echoes reflected from the ionosphere are derived from general ray equations. Based on these relationships, a method is proposed to invert the height profile of the electron density, $N(Z)$, and the height profile of the normal velocity, $V(Z)$, of the constant electron density surface from the observed Dopplionogram, gonionogram, ionogram and rangionogram. In addition, comparing the possible combinations of the radio wave observations which are necessary and sufficient for the determination of the height profiles of $V(Z)$ and $N(Z)$, the authors suggest a new ionosonde operation mode to observe large-scale ionospheric disturbances, such as the gravity waves from a single station. This may be the theoretical basis for data analysis and instrumental improvement of the modern ionosonde.

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CSO: 4009/55

ELECTROSTATIC ION CYCLOTRON AND ION ACOUSTIC WAVE INSTABILITIES DRIVEN BY
UPGOING OXYGEN ION (O^+) BEAMS ON AURORAL FIELD LINES

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese
Vol 7 No 2, Apr 87 pp 103-116

[English abstract of article by Zhou Guocheng [0719 0948 2052] and Wang Deju
[3769 1795 7467] of the Institute of Space Physics, Chinese Academy of Sciences]

[Text] An investigation is made of the instabilities of an electrostatic oxygen ion (O^+) cyclotron and ion acoustic waves in a model plasma consisting of background hot electrons, background cold protons (H^+) and strongly anisotropic oxygen ion beams. It is shown that the lower frequency and electrostatic O^+ ion cyclotron and ion acoustic waves may be excited by upgoing O^+ ion beams on auroral field lines. Upgoing O^+ ion beams may be an important source of free energy for the lower frequency and electrostatic instabilities on auroral field lines.

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CSO: 4009/55

METHOD ESTIMATING INTEGRAL MEAN VALUE OF ENHANCEMENT FACTOR AND PATH LATITUDE FOR WHISTLERS BELOW MAGNETIC LATITUDE 10°

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese
Vol 7 No 2, Apr 87 pp 146-153

[English abstract of article by Wang Youshan [3769 0645 0810] of the Department of Earth and Space Science, University of Science and Technology of China]

[Text] The propagation of whistler-mode waves in the ionosphere is assumed to be ducted propagation. In other words, the waves will be presumed as travelling along magnetic field lines. An analytic solution of the whistler dispersion equation is obtained in terms of the electron density models of the ionosphere, the transverse gradient of the electron density required for guiding whistler-mode waves along a magnetic field line, and an empirical formula for the magnetic field lines of the 1980's IGRF ($n=8$). In this paper, the electron density enhancement factor is defined as N_c/N_g-1 (N_c is the electron density at the center of the duct; N_g is the background electron density at the latitude where the duct center lies). Thus, the integral mean value of the enhancement factor required and the path latitude (i.e., the exit point latitude of whistlers) can be analytically determined by a set of observed values: N_mF2 and h_mF2 of the ionosphere, and D (whistler dispersion). Using the data of D , N_mF2 and h_mF2 on Hainan Island, China, the above evaluation and the following conclusions are made: (1) The integral mean value of the enhancement factor required for ducting of low-latitude whistlers ranges from 7 percent to 31 percent. (2) The whistler dispersion D has a positive correlation with N_mF2 ; and a negative correlation with h_mF2 when the path latitude $\phi_{90} \leq 10.5^\circ$ (IGRF, $n = 8$). Conversely, if $\phi_{90} > 12^\circ$ (IGRF, $n = 8$), D has a positive correlation with h_mF2 . It is found that 94.5 percent of the whistlers observed at Sanya ($18.24^\circ N$, $109.5^\circ E$; geomag. lat. $7.04^\circ N$; IGRF, $n = 8$, lat. $9.64^\circ N$) on Hainan Island have path latitudes of $\phi_{90} \leq 10.5^\circ$. Therefore, D should have a negative correlation with h_mF2 , which is consistent with observations.

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CSO: 4009/55

STUDY OF DEPHOSPHORIZATION IN POWDER INJECTION PROCESS FOR HIGH CHROMIUM STAINLESS STEEL

Beijing GANGTIE [IRON AND STEEL] in Chinese Vol 22 No 4, Apr 87 pp 20-27

[English abstract of article by Zhang Shufan [1728 2885 5672], et al., of the Central Machine Design and Research Institute, MMBI; Zhi Shui [4249 3055], et al., of the Central Iron and Steel Research Institute; Yu Yuhong [0205 5148 1347], et al., of Guangzhou Heavy Machine Building Plant]

[Text] The experimental results of a new dephosphorization process for high chromium stainless steel are discussed. The main features of the process are the utilization of powder injection technology with calcium alloys CaSi , CaC_2 or $\text{CaC}_2 + \text{CaSi}$ injected into the hot metal as a dephosphorizer and with argon as a carrier under reducing conditions. Results show the rate of dephosphorization reaches 74-89 percent and the phosphorus content in steel is reduced to 0.005-0.010 percent after injection of 18-8 stainless steel. Similarly, the dephosphorization rate is 71-78 percent and phosphorus content 0.013-0.014 percent for CrMnNiN stainless steel under industrial conditions with approximately 45-50 kg of powder injected per ton of steel and an initial injection temperature of 1500-1530°C. In addition, the influences of temperature, oxygen content and chemical compositions of the molten steel together with the furnace lining materials on the rate of dephosphorization are analyzed.

9717

CSO: 4009/62

NEW TEEMING TECHNOLOGY FOR RIMMED STEEL INGOT--THE 'ZF' PROCESS

Beijing GANGTIE [IRON AND STEEL] in Chinese Vol 22 No 4, Apr 87 pp 28-32

[English abstract of article by Hu Lin [5170 2651], et al., of Anshan Institute of Iron and Steel Technology; Xu Yongguo [1776 3057 0948], et al., of Anshan Iron and Steel Company]

[Text] The "ZF" process is a new process to teem rimmed steel ingots which has been researched and developed in China. Using this process, the bloom yield is increased by 3-4 percent, and the average charging temperature reaches 1006.2°C, an increase of 150-180°C. This process is quite efficient, ensuring liquid core heating and rolling. Due to the higher charging temperature, the fuel consumption is decreased by 40 percent, the loss during heating reduced by 0.05-0.7 percent, and the capacity of the soaking pit is increased by 30 percent. Through this process, the same kind of molds can be used to teem either killed or rimmed steel. The percentage of quality ingots reaches 99.66 percent, an increase of 0.44 percent when compared with that of ingots teemed by the conventional process. The ZF process has been put into production at the Nos 1 and 2 steel making plants of Anshan Iron and Steel Company, the steel making plant of Panzihua Iron and Steel Company and some others as well, with more than 2×10^6 T rimmed steel ingots having been produced using this process. The economical benefit is about 5.82 Yan (RMB) per ton ingot. The ZF process has been assigned as one of the key processes to be put into use across China.

9717

CSO: 4009/62

**TENSILE STRENGTH AND DEFORMATION BEHAVIOR OF PEARLITE-LIKE FERRITE PLUS
MARTENSITE DUAL-PHASE STEEL**

Beijing GANGTIE [IRON AND STEEL.] in Chinese Vol 22 No 4, Apr 87 pp 45-52, 19

[English abstract of article by Sun Shuming [1327 2562 2494], et al., of Harbin Institute of Technology]

[Text] The microstructure and tensile properties of a pearlite-like type of dual-phase steel are compared with those of the island type, and the two types of dual-phase structure are then analyzed using the Jaoult-Crussard technique. It is found that the pearlite-like type of ferrite plus martensite dual-phase structure has higher work-hardening rates at higher strains and better combinations of strength and ductility than does the island type. For estimating yield strength of dual-phase steel, a formula is suggested using λ_F (mean free path in ferrite) as a parameter. The reasons for the pearlite-like type dual-phase structure having better tensile properties are studied in terms of microstructure, strength change features and work-hardening behavior, etc.

9717

CSO: 4009/62

THERMOMECHANICAL TREATMENT OF SUPERSATURATED SOLID SOLUTION OF LD-2 ALUMINUM ALLOY

Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 23 No 2,
18 Apr 87 pp A118-A122

[English abstract of article by Zheng Yangzeng [6774 3568 2582], et al., of the Northeast Heavy Machinery Institute, Fulaerji, Heilongjiang]

[Text] Hot torsion tests were carried out on a supersaturated solid solution of an aluminum alloy containing 0.7 percent Mg and 0.97 percent Si. The flow curves at 480/400/270°C and a strain rate of 1.31 s^{-1} were measured. The dynamic structure changes and their influences on the subsequent aging behavior of the alloy quenched immediately after hot deformation were investigated. It has been found that the aging-hardening ability and the time preceding peak hardness of the supersaturated solid solution quenched directly after hot deformation are related to the dynamic precipitation of Mg_2Si . Under the conditions of the absence or presence of a small amount of the precipitates, the ability is about 15 percent higher and the time an order of magnitude shorter for the sample quenched immediately after deformation than for that quenched conventionally. The microstructure of the sample hot deformed, directly quenched and aged is characterized by the existence of recovery substructures as well as much finer dispersive aging precipitates. (Received 27 Aug 85; revised 17 Apr 86.)

9717

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EFFECT OF Ti ON PRECIPITATION AND MICROSTRUCTURAL PARAMETERS OF Al-Zn-Mg ALLOY

Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 23 No 2,
18 Apr 87 pp A129-A135

[English abstract of article by Lin Zhaoqi [2651 5128 3823], et al., of
Northeast Institute of Technology, Shenyang]

[Text] The effects of an additive of 0.15 wt-percent Ti in the Al-5.0Zn-1.8Mg alloy on the precipitation, critical nucleation temperature, T'_C and structural parameters have been investigated by means of a hardness test as well as optical and TEM observations. The results show that a trace additive of Ti may impel considerably the refinement of the grains of the alloy, but does not inhibit its recrystallization or increase of T'_C . Ti may retard the growth of MPt and increase the density and the hardness of the alloy under lower temperature aging, namely, $T_a < T'_C = 150^\circ\text{C}$, but it meets with the reverse under $T_a > T'_C$. In addition, at any aging temperature between 120 and 200°C , the GBP and PFZ of the Ti-containing alloy are always finer and narrower than those of an alloy free of Ti. It seems that the influence of the Ti addition on the precipitation and structural parameters is caused by the participation of Ti atom clusters in the nucleation of the GP zone and the low concentration of excess vacancies in the Ti-containing alloy. (Received 1 Aug 85.)

9717

CSO: 4009/57

INFLUENCE OF RARE EARTHS ON MECHANICAL BEHAVIOR AND SOLID-LIQUID COEXISTING ZONE OF Al-Cu ALLOYS DURING SOLIDIFICATION

Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 23 No 2, 18 Apr 87 pp B62-B67

[English abstract of article by Li Qingchun [2621 1987 2504], et al., of Harbin Institute of Technology]

[Text] The influences of La, Y, Ce and mischmetal on the mechanical behavior and solid-liquid coexisting zone of Al-Cu alloys during solidification have been investigated with specially-designed equipment. An addition of rare earths will achieve, to some extent, the lowering of the quasi-solidus, widening the quasi-liquid region and narrowing the quasi-solid region. Rare earths enhance the strength around the solidus, remarkably increasing the strength of the alloys. In addition, they are able to decrease the temperature and increase the stress of the hot cracking formation, resulting in a decrease in the tendency toward hot cracking. The solubility of rare earths in α -Al is very low. Their existence makes the size of dendrites fine and increases the interdendritic strength at the later stages of solidification. (Received 12 Apr 85; revised 10 Dec 85.)

9717

CSO: 4009/57

ANALYSIS OF PASSIVE FILMS OF Al ALLOYS BY XPS DEPTH PROFILE

Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 23 No 2,
18 Apr 87 pp B101-B107

[English abstract of article by Wang Danghan [3769 3981 2003], et al., of the
Institute of Chemistry, Chinese Academy of Sciences, Beijing; Guo Baolan
[6753 1405 5695], et al., of Beijing Institute of Aeronautics and Astronautics]

[Text] An XPS depth profile analysis has been made of passive films on one Al-Mg alloy and two Al-Cu alloys. It is shown that in the $K_2Cr_2O_7$ treated passive films on these alloys, a certain amount of Cr_2O_3 appears in addition to the large amount of Al_2O_3 . Therefore, the on-going argument regarding the presence of Cr_2O_3 is now settled. It has also been observed that in the passive films obtained through treatment with N_2 -containing passivation agents, some AlN and metallic complexes are detected in addition to Al_2O_3 . Furthermore, no Cu is signaled in the passive film on two Al-Cu alloys obtained by either $K_2Cr_2O_7$ or N_2 -containing passivation agents, and Cu is shielded by the passive film. The authors note that a definite Mg peak can be observed on these two passive films, although the Mg content in the Al-Cu alloy is very low, but this peak disappears after sputtering for 5 minutes. (Received 4 Jan 85; revised 10 Oct 85.)

9717

CSO: 4009/57

LINEAR MINIMUM VARIANCE FILTER FOR PASSIVE LOCALIZATION

Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 12 No 3, May 87
pp 210-217

[English abstract of article by Wu Guoqing [0702 0948 3732] of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] A simple and effective post-processing method for passive localization is proposed. The passive localization post-processor concerns estimating the time varying state of a dynamic system. Usually this is done with a Kalman filter. This paper applies the Linear Minimum Variance (LMV) method, which is generally used for parameter estimation, for estimating the varying state of a linear dynamic system. Therefore, the new method can be called the LMV filter. In fact, it is a weighted average method because the LMV filter takes weighted averages of K samples observed with different weight coefficients which are given by a system of equations. A basic assumption involving source motion is to consider it to be of constant velocity with random perturbations over the observed intervals. Two simulation results are presented which show that the range estimate converges quickly and well, no divergence appears, and the method can be adapted for target maneuvers. Another important feature is its very low computational level which is useful in cases of poor computer facilities. (Received 29 Dec 84.)

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CSO: 4009/59

MEASUREMENT OF TWO-DIMENSIONAL BOTTOM BACKSCATTERING COEFFICIENTS AT SHALLOW WATER

Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 12 No 3, May 87
pp 227-231

[English abstract of article by Jin Guoliang [6855 0948 0081], et al., of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] A frame with 10 transducers, spaced vertically in intervals of 0.5 m, has been mounted on the sea bottom to measure the monostatic and bistatic backscattering from the sea floor. The bottom was sandy silt and the water depth about 63 m. Each of these transducers in turn transmitted sound pulses at a frequency of 10 kHz and the rest (or the same one) received the signals scattered from the bottom. In this way the bottom backscattering coefficients were measured as a function of both incident and scattering grazing angles ($0.6-40^\circ$). In addition, the bottom reflection coefficient and reverberation intensities were also measured in the same area under thermocline conditions. By feeding the measured bottom scattering and reflection coefficients as well as the sound-speed profile into the reverberation model published in a previous article, the authors have estimated the reverberation intensities which are in good agreement with those of the measured data. (Received 20 Dec 84.)

9717

CSO: 4009/59

COMPUTATION OF OPTIMUM TURBOFAN MIXING WITH SUBACCURATE VARYING SPECIFIC HEAT SOLUTION

Beijing GONGCHENG XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS]
in Chinese Vol 8 No 2, May 87 pp 107-109

[English abstract of article by Cui Jiya [1508 3444 0068] of Beijing University of Aeronautics and Astronautics]

[Text] Optimum fan vs mainstream mixing total pressure ratios are computed by means of a recently developed three k 's subaccurate varying specific heat method, i.e., k_x at critical temperature, k_v and k for respective specific heats from total temperature to critical and to static temperatures.

For inviscid parallel mixing, the optimum resulting total pressure is obtained with two mixing streams' total pressures not far from equal, while there is a flat region of only slight variation with the fan pressure ratio on either side. Some common misleading conceptions are therefore clarified.

9717

CSO: 4009/60

THREE-DIMENSIONAL CALCULATION IN HIGH SUBSONIC AXIAL COMPRESSOR ROTOR AND ITS
COMPARISON WITH L2F VELOCITY MEASUREMENT

Beijing GONGCHENG XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS]
in Chinese Vol 8 No 2, May 87 pp 119-124

[English abstract of article by Wang Qinghuan [3076 1987 2719], et al., of
the Institute of Engineering Thermophysics, Chinese Academy of Sciences]

[Text] As a part of a basic research program to increasing the understanding of the internal flow in high subsonic and transonic flow compressors and to improve the design and analysis calculation methods, the Laser-2-Focus (L-2-F) velocimeter has been employed to measure the velocity and flow angles in a compressor rotor running at peak-efficiency points of several partial design speeds. The three-dimensional flow calculation has also been undertaken for these off-design conditions. The outlet velocity measured by the L-2-F velocimeter, outlet stagnation pressure measured by pitot tubes and isentropic rotor efficiency measured by a phase-difference torquemeter are used as input values for the theoretical calculation. The variation of flow on the S_{2m} surface and on the S_1 surfaces measured by the L-2-F velocimeter, in general, agrees reasonably well with the calculated variation. This indicates that the three-dimensional calculation method used can provide a good picture of the internal flow in the compressor rotor.

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CSO: 4009/60

FINITE ELEMENT ANALYSIS OF THREE-DIMENSIONAL STEADY AND UNSTEADY TEMPERATURE FIELDS (COMPUTATION OF TEMPERATURE DISTRIBUTION OF TURBINE BLADE WITH COMPOSITE COOLING)

Beijing GONGCHENG XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS]
in Chinese Vol 8 No 2, May 87 pp 159-165

[English abstract of article by Ji Shouli [0370 1343 4409], et al., of Beijing Institute of Aeronautics and Astronautics]

[Text] Three-dimensional temperature distributions of steady and unsteady states for a turbine blade have been calculated using the finite element method. The boundary condition consists of convective heat transfer of gas heating, internal cooling, film cooling and impinging cooling. The results show that the temperature distribution of the computed blades is satisfactory and the computing program is suitable for practice.

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CSO: 4009/60

NUMERICAL SIMULATION OF FLOW FIELD IN REACTOR PRODUCING TiO

Beijing GONGCHENG XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS]
in Chinese Vol 8 No 2, May 87 pp 180-183

[English abstract of article by Qin Chaobin [4440 2600 2430], et al., of the Institute of Engineering Thermophysics, Chinese Academy of Sciences; Zhang Sen [1728 2773], et al., of the Institute of Chemical Metallurgy, Chinese Academy of Sciences]

[Text] In this paper, a numerical simulation is used in the flow field of a reactor which produces TiO_2 . The ω - ψ method is applied, and the computational field is divided into several sub-regions in order to overcome the difficulty of irregular boundaries. After considering the swirl velocity V_s , an unusual circulating flow field appears. In calculating the reacting flow, a new model for non-premixed chemical reactions is presented and the mass fractions of species are calculated. The numerical calculation is verified through experimental results.

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CSO: 4009/60

STUDIES OF ANALGESIC ACTION AND PHYSICAL DEPENDENCE OF BULLEYACONITINE A

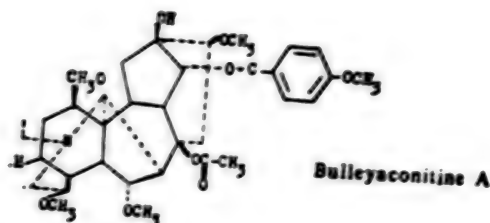
Beijing YAOXUE XUEBAO [ACTA PHARMACEUTICA SINICA] in Chinese Vol 21 No 12,
29 Dec 86 pp 886-891

[English abstract of article by Tang Xican [0781 1585 3503] of Shanghai
Institute of Materia Medica, Chinese Academy of Sciences]

[Text] Aconitum bulleyanum Diel is an herb which has been used as an anodyne in Yunnan Province for a long time. Bulleyaconitine A (Bul), an active principle, was extracted from this herb. The analgesic action of Bul is shown in this paper using the following methods: mice writhing evoked by ip 0.7 percent acetic acid 10 ml/kg; mice hot plate (56°C); continuous pain stimuli elicited by sc formaldehyde in front paw and rat tail-flick response to light irradiation. The relative analgesic effect of Bul was found to be 1.8 ~ 3.25, 15.3 ~ 65.5 and 1208 ~ 7195 times as potent as 3-acetylaconitine, morphine and aspirin, respectively. The duration of the analgesic effect of Bul assayed with pain stimuli of formaldehyde in mice was longer than that of morphine. No tolerance of the analgesic effect was found after daily sc of Bul 0.15 mg/kg for 9 days in mice assayed with the hot plate method. In the nalorphine-challenge test, no jumping response was observed in mice treated with Bul 1.2 mg/kg, the maximum tolerance dose. Rats were given sc morphine 25 mg/kg bid for 120 days, with withdrawal of morphine being followed by a decrease in body weight which served as a parameter of the abstinence syndrome. However, Bul sc 0.1 mg/kg did not alter the weight loss of morphine-treated rats. One male monkey developed physical dependence after sc morphine in which the daily dose was increased progressively from 2.5 to 25 mg/kg in 21 days and then maintained for 120 days. Bul 30 µg/kg sc did not suppress the withdrawal signs evoked by ip nalorphine 0.5 mg/kg. The results indicate that Bul induced no morphine-like tolerance or physical dependence.

The analgesic action of Bul was not antagonized by naloxone, but was eliminated by intraperitoneal injection of reserpine 3 mg/kg 3 hours prior to Bul. The antagonistic action of reserpine to Bul could be reversed by icv 5-HT or ip 5-HTP given 3 hours after reserpine. Therefore, the analgesic effect of Bul may be related to the 5-HT level in the brain.

It was found that Bul exhibited strong local anesthetic activity when injected around the sciatic nerve in mice, with the ED₅₀ concentration of Bul (50 percent of mice with signs of sciatic nerve block) being 0.0029 percent.



(Received 26 Mar 86.)

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CSO: 4009/1105

STUDIES OF SYNTHESIS OF SALICYLAMIDES AND ALKAMINE SALTS OF NICLOSAMIDE AND THEIR ACTIVITIES AGAINST SCHISTOSOMA JAPONICUM AND ONCOMELANIA

Beijing YAOXUE XUEBAO [ACTA PHARMACEUTICA SINICA] in Chinese Vol 21 No 12, 29 Dec 86 pp 935-938

[English abstract of article by Zhang Zhaorui [1728 3564 3843] of Nanjing College of Traditional Chinese Medicine; Liu Yisun [0491 6318 1327] of Shanghai Medical University]

[Text] Two series of salicylamides (I and II) and alkamine salts of niclosamide (III) have been prepared. Methyl salicylate was reacted with hydroperoxide and hydrochloric acid, and then condensed with amines to produce 5-chloro-salicylamides (I). The reaction of salicylamide or 5-chloro-salicylamide with formaldehyde and cyclic aliphatic amine through the Mannich reaction provided compounds (II). Aliphatic amine salts of niclosamide (III) were obtained by adding amines to niclosamide.

Compounds of series III were found to possess pronounced activity against Oncomelania and cercaria of Schistosoma japonicum in mice. Among them, compound IIIa exhibited a rather good cidal effect against 20-day-old immature Schistosomes by oral administration. However, compounds of series I and II showed no activity.

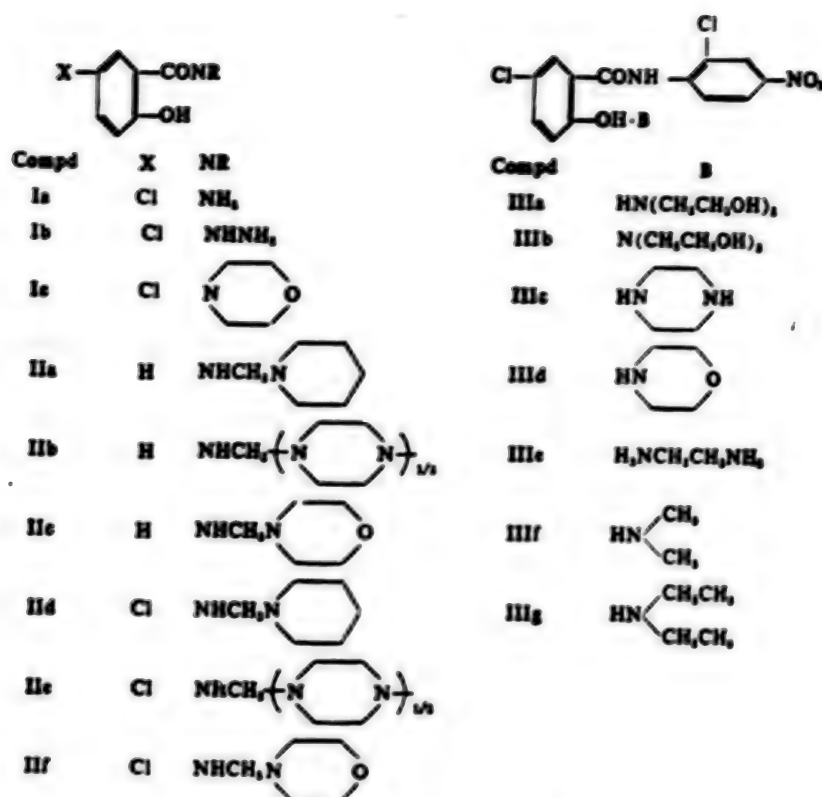


Fig 1. structures of the compounds synthesized

(Received 31 Oct 85.)

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CSO: 4009/1105

GENETIC VARIATION OF ADHI IN YEAST SACCHAROMYCES CEREVISIAE*

Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 14 No 1, 1987
pp 1-7

[English abstract of article by Wu Peipei [0702 1014 1014], et al., of the
Department of Biology, Hangzhou University]

[Text] Seven strains on Saccharomyces cerevisiae from five countries were compared for the characteristics of alcohol dehydrogenase I (ADHI). The results reveal a new class of ADHI(F) differing in electrophoretic mobility from the previously reported ADHI(S). This ADHIF can be synthesized in 10 per cent glucose cultural conditions and in the anaerobic growth of respiratory deficient strains. The genetic analysis of 2.1168-6D(ADHIF) and A364A(ADHIS) shows that ADHIF is controlled by the gene ADC-1F, which is allelic, with the structure gene ADC-1S encoding ADHIS. (Paper received 22 Mar 86.)

* Project supported by the Science Fund of the Chinese Academy of Sciences.

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CSO: 4009/1101

INDUCTION OF ENDOSPERM PLANTS IN LYCIUM CHINENSE MILL. VAR. POTANINII (POJARK)
A.M. LU. AND EXAMINATION ON CHROMOSOME PLOIDY

Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 14 No 1, 1987
pp 37-41

[English abstract of article by Gu Shurong [7357 3219 2837], et al., of the
Institute of Botany, Chinese Academy of Sciences, Beijing]

[Text] Immature endosperm explants of Lycium chinense Mill. var. potaninii (Pojark) A.M. Lu. were cultured on a MS basic medium supplemented with 1 ppm 2, 4-D, 0.1 ppm KT and 5 percent sucrose. The induction frequency of calli amounted to 23.8 percent. Endosperm cultured with an embryo was not absolutely necessary for production of the calli. However, when the embryo existed in the endosperm, the induction frequency of the calli was increased. The chromosome number was unstable in cells of endosperm plantlet root tips. They were triploid ($2n = 3x = 36$), diploid ($2n = 2x = 24$) and aneuploids (9, 18, etc.). The chromosome numbers of 15 endosperm plantlets were examined in which the ratio of the triploid plants was 73.3 percent. (Paper received 16 Dec 85.)

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CSO: 4009/1101

GENETIC POLYMORPHISM OF FOURTH COMPONENT OF HUMAN COMPLEMENT (C4) IN HAN NATIONALITY OF WUHAN DISTRICT, CHINA

Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 14 No 1, 1987 pp 69-76

[English abstract of article by Zhang Wenjie [1728 2429 2638], et al., of the Department of Pathophysiology, Tongji Medical University, Wuhan]

[Text] One hundred eighty unrelated Chinese (Han nationality) were investigated for C4 polymorphism by immunofixation and hemolytic overlay techniques after high voltage electrophoresis on neuraminidase treated plasmas. Five variants at the C4A locus and six variants at the C4B locus were found, with silent alleles also existing at both C4A and C4B. Thirty-two different C4A, B phenotypes were detected, and the following gene frequencies were obtained: C4A*4, 0.014; 3, 0.633; 2, 0.192; 1, 0.011; 91, 0.003; Q0, 0.147 and C4b*3, 0.006; 2, 0.127; 1, 0.751; 92, 0.041; 9W, 0.003; 96, 0.006; Q0, 0.066. Individuals with phenotypes of single null C4A (C4A Q0) and C4B (C4B Q0) accounted for 28.3 percent and 11.1 percent, and those with phenotypes of double null C4A (C4A Q0, Q0) and C4B (C4B Q0, Q0), 0.56 percent and 1.11 percent of the total, respectively. The distributions of C4A and C4B gene frequencies in this population were in agreement with those expected from the Hardy-Weinberg equilibrium by the χ^2 test. (Paper received 15 Jan 86.)

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CSO: 4009/1101

Hb F URUMQI G_{γ}^1 22(B4)Asp \rightarrow Gly: A NEW FETAL HEMOGLOBIN VARIANT FOUND IN UYGUR NEWBORN BABY

Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 14 No 1, 1987 pp 77-81

[English abstract of article by Hu Huaiyu [5170 2037 6877], et al., of the Department of Biology, Xinjiang Medical College]

[Text] A slowly moving Hb F variant was detected in a Uygur baby during a cord blood screening carried out in Urumqi. The abnormality was connected with a substitution of Gly for Asp at position 22 of the γ chain. The variant has an Ile residue in position $\gamma 75$ and a Gly in $\gamma 136$. It has been named Hb F Urumqi. The heat stability test was negative. (Paper received 14 Oct 85.)

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STANDARDIZATION GOALS FOR 1987 OUTLINED

Beijing ZHONGGUO BIAOZHUNHUA [CHINA STANDARDIZATION] in Chinese No 3,
5 Mar 87 pp 2-4

[Text] Not long ago, the State Standardization Bureau issued to the standardization (standard measurement) bureaus of all provinces, autonomous regions, municipalities and cities directly under the central government, and standardization administrative organs of the relevant departments of the State Council an outline of national standardization goals for 1987 with the request that all regions and departments work out concrete plans in light of their own realities. The notice said that 1987 is the second year of China's Seventh 5-Year Plan and a crucial year in which to continue implementing the spirit of the conference on the nationwide adoption of international standards. We must carefully plan this year's work with a view to improving the quality of products, upgrading the enterprises, raising the standard of management, and guiding the work of standardization on a new path. Highlights of the "Outline of National Standardization Goals for 1987" are as follows:

Nineteen eighty-seven is the second year of the Seventh 5-Year Plan and the crucial year to continue our efforts to implement the spirit of the conference on the nationwide adoption of international standards. In a new historical context, standardization workers have the important task of actively adopting international standards to meet the requirements of economic construction, new technical developments, and export expansion in foreign trade. We must have a radical change in our understanding, a thorough reform in our work, and a marked improvement in the competence of our personnel. We must carefully attend to the following tasks in order to improve the quality of products, upgrade enterprises, and raise the standard of management.

1. Further Readjust the Guiding Thought of the Task of Standardization, Make the Reform Successful

1. To accelerate the adoption of international standards is an important technological and economic policy as well as an important measure in implementing the policy of opening to the outside and improving the quality of products in China. To attain the strategic objective of improving the quality of products as called for in the Seventh 5-Year Plan, the standardization departments must strongly support the reform, strengthen their macroeconomic management, study

the required principles and policies, work out unified programs and plans, set up and improve the legal system, and exercise intensive supervision over quality.

2. There must be unified leadership and a division of labor in standardization. We must reform the system of standardization, enforce the responsibility system, fully mobilize the initiative of all departments and localities, and accelerate the adoption of international and advanced foreign standards. We must earnestly implement the "Supplementary Provisions (provisional) for Working out the Procedures for the National Standardization of Industrial and Agricultural Products," the "Constitution of the National Technical Committee in Charge of Specialized Standardizations," and the "Regulations for the Control of the Publication and Distribution of National Standards for Industrial and Agricultural Products," and we must carefully reform the work of formulating, examining, approving, publicizing, publishing, and disseminating national standards. We must implement the policies for the classification of the indices of standard qualities and properties, the grading of products, and the practice of pricing according to quality, and we must encourage enterprises to produce fine-quality products.

3. Priority should be given to the reform of standardization planning. Plans should give prominence to key products which will serve as the basis for setting standards and allocating funds. We should gradually change the current practice of giving no priority to key products and allocating funds with no reference to the standards.

4. We should explore the reform in the structures and organizations of standardization management in the localities, and use the economic structural reforms and organizational reforms in Dandong, Weifang, Suzhou, Wuxi, Changzhou, Maanshan, Xiamen, Shaoxing, Luoyang, Huangyang, Huangshi, Hengyang, Zigong, Baoji, Tianshui, and Jiangmen as experimental units in standardization. We must keep abreast of the situation, provide active guidance, sum up our experiences, and promote reform of the standardization front.

II. Continue To Implement the Spirit of the Conference on National Adoption of International Standards, and Accelerate Their Adoption

1. During the Seventh 5-Year Plan, we should actually adopt international standards or advanced foreign standards for more than 6,000 major industrial and agricultural products. These standards should be adopted for separate groups and in different periods, but the adoption of at least one-third of the standards should be completed in 1987.

2. We should selectively adopt international or advanced foreign standards for more than 2,400 types of industrial and agricultural products that are urgently required for economic construction, new technology developments, and foreign trade exports. All departments should work out the arrangements for 1987 and 1988 step by step. They should pay particular attention to the work of revising and supplementing the national standards of those industrial and

and agricultural products for which international or advanced foreign standards have been adopted, and ensure that the adoption of international standards for more than 2,400 major industrial and agricultural products is completed before the end of 1988.

3. For readjustment of the industrial production structure, efforts should be made to increase the variety and improve the quality of textile products, important raw materials, and electronic and mechanical products. We should carefully organize the national standards for 1,500 major products to meet the supplementary requirements.

4. For some 4,400 international standards which are suitable for China but have not yet been adopted, all technical departments should arrange for their adoption year by year. Adoption of the 2,500 or more standards which have been appraised should be completed in 1987, and an effort should be made to convert all of them to Chinese standards before 1990.

5. All localities should select their own industrial and agricultural products and those products that are supplementary to 6,000 major national products, adopt international or advanced foreign standards, and make an effort to improve their quality.

III. Strengthen Quality Supervision, Conduct Quality Appraisal To Improve Product Quality

1. In accordance with the policy of "comprehensive arrangement, division of labor in cooperation, organization for coordination, and supervision over service," we should continue to streamline their relationships, bring into play the initiative of the central and the local authorities, further strengthen management, improve the quality and efficiency of supervision, and enlarge the scope of supervision and inspection.

2. We should further improve the work of spot-checking for quality and gradually increase the varieties to be spot-checked. The set standards should be strictly followed in our check-ups. Spot-checks should also be stepped up on market commodities and the products of rural enterprises.

3. We should speed up the establishment of supervision and inspection organs, and raise their efficiency so that the required examination and approval may be expedited. The first group of 113 state supervision, inspection, and monitoring centers should proceed in earnest with their tasks of examination and approval. We should plan for the establishment of an additional 100 such centers as the second group.

4. We should set up a system of authentication for products adopting international or advanced foreign standards. We must authenticate not only the international or advanced foreign standards adopted but also the suitability of the technical process, the means of monitoring, and the gauges and models used by the enterprises.

5. We should continue to improve our work and enlarge the scope of licensing so as to speed up the issuance of licenses. The "Regulations on the Strict Prohibition of Producing and Selling Products Without the Required Licenses" must be enforced, and the prohibition on unlicensed production must be strictly enforced.

6. We must also set high standards and strict demands, and carefully organize the work of evaluating fine-quality products according to national standards.

IV. Further Strengthen the Work of Standardization in Localities

1. Special attention should be paid to the work of standardization in the special economic zones, the coastal cities, and the cities directly under the central government. These cities should be encouraged to speed up their adoption of international and advanced foreign standards, develop the system of quality and safety authentication, utilize favorable conditions for the extensive collection of information on international standardization, and explore new avenues of standardization.

2. The work of standardization in agriculture should be strengthened according to local conditions, and particular attention should be paid to the selection of several important local agricultural products for comprehensive standardization so as to improve the scientific management of agriculture and the quality of products.

3. We should vigorously proceed with the standardization of enterprises in collaboration with higher-level authorities, strengthen basic enterprise management, and encourage the enterprises to continue to improve their operations.

4. We should explore avenues for the standardization of rural enterprises, make every effort to eliminate nonstandard production, actively supervise the quality of products, provide consultation services for the "spark plan" concerning standards and the means of checking them, and help the rural enterprises continue to improve the quality of their products.

V. Strengthen the Standardization of the Legal System

1. We should revise the "Standardization Law (Draft) of the People's Republic of China" and proceed to organize the drafting of "Rules and Regulations for the Implementation of the Standardization Law of the People's Republic of China" and specific related regulations.

2. We should carefully attend to preparations for the propagation and implementation of the "Standardization Law of the People's Republic of China," compile the required materials in the form of videotapes and TV shows, and print propaganda posters.

3. All departments and localities should intensify their investigations and studies and supervise the implementation of all standardization statutes.

VI. Strengthen the Work of Information Data Processing, Propaganda, and Education Concerning Standardization

1. We should enhance our spirit of service, form the concept of serving the basic-level units and enterprises, and make full use of the network of various standardization information-processing facilities in order to set standards for the factories and rural areas. We should also actively provide various types of standardization data and technical consultation services.
2. In the spirit of reform, we should accelerate the printing, publication, and distribution of national standards, specialized (or ministry) standards, and local standards to meet the requirements of various quarters in good time.
3. Great importance should be attached to intellectual development, and education in standardization should be carefully carried out. The compilation and publication of teaching materials should be accelerated, and various types of training classes should be held. We should also raise the competence of standardization personnel in order to lay a good foundation for the development of standardization.
4. Publicity work should be carefully attended to. We should make full use of newspapers, magazines, movies, TV shows, and various symposiums to strengthen propaganda on and the implementation of standardization and to popularize our knowledge of and the theory of standardization.

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SCIENCE, TECHNOLOGY PERSONNEL ISSUES IN SHANGHAI DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 87 pp 4-6

[Article by Qian Zhenmeng [6929 2182 5536], deputy director of the Staff Office of the Science and Technology Leading Group, State Council: "Review the Past, Look Forward to the Future: A Talk Given at a Meeting To Study the Present Condition of Shanghai's Skilled Personnel and Related Policies--December 1986"]

[Text] Since the Central Committee decided on reforming the science and technology system in March 1985, a series of measures have been adopted to implement the strategic policy on the reliance of economic construction on science and technology which, in turn, must be oriented to economic construction. These measures have won the understanding and support of the entire society and the broad masses of science and technology personnel, and have achieved preliminary success in reforming the regulations on fund allocations for science and technology, developing technology markets, expanding the decision-making power of the scientific research organs, promoting the integration of scientific research and production, increasing the enterprises' power over technology assimilation and development, and reforming the system of professional and technical cadre management.

I. Rapid Progress of Reform in Fund Allocations for Science and Technology

The Ministry of Finance was formerly in charge of the allocation of operating funds for the scientific research organs of 53 departments in the civilian sector. This responsibility has now devolved on the State Science and Technology Commission SSTC. The operating funds of research institutes engaging in technological development (about 36 percent) have been reduced by about 10 percent this year. Of the 4,690 scientific research and technology development organs affiliated with the government departments at or above the county level in China, 1,499 (32 percent) have adopted the technology contract system, 317 (6.8 percent) are now economically independent, and 640 (13.6 percent) have reduced their operating funds. Reform in the allocation of funds in the localities has made an all-out start. The organs offering scientific and technical services to the society and engaging in agricultural scientific research have adopted the system of responsibility for surpluses and deficits. This year, the State Natural Science Foundation was established, and the system of allocating funds for scientific purposes was adopted. Up to now, applications have been received for more than 12,000 projects, and the funds applied for total 1.2 billion yuan. These projects are now being evaluated. The system of public bidding is being gradually introduced for the state's important science and technology projects.

Reform in the fund allocation system has induced the science and technology organs to devote more effort to economic construction, to the development of various forms of horizontal integration, and to the transformation of scientific and technical achievements into productive forces. By the end of last year, the operating funds for all research units in the country totaled 2.8 billion yuan, and their actual net income totaled 900 million yuan, nearly one-third of their operating funds.

The mandatory plans for science and technology may be classified into six categories, namely, the plan for "tackling key projects," "spark plan," "advanced technology plan," "key laboratory construction plan," "intermediate tests plan," and "technology importation plan." The "spark plan," in particular, has won high praise from various localities and throughout the world. By now, the state has appropriated for this plan the sum of 360 million yuan, which, with the addition of local investments, will amount to about 2.3 billion yuan. This amount will play an important role in invigorating the rural and local economies.

II. Role of Technology Markets Increasingly Apparent

An exchange fair for the transfer of military technology to civilian use held in March and the national exchange fair for technical achievements held in May of last year produced fairly strong repercussions. They were followed by similar exchange fairs in many departments which also produced fairly good results. Signs of prosperity appeared in the technological markets. Later, because of the tight money market and the reduced scale of capital construction, the problem of funds became rather acute, and a recession began in the technology markets in the second half of last year. With further economic improvement next year, however, it is anticipated that these markets will again flourish.

III. Scientific Research-production Integration Highly Auspicious

The Central Committee and the State Council have repeatedly advocated and encouraged horizontal economic integration. In December of last year, the Science and Technology Leading Group of the State Council held a nationwide meeting in Dalian to exchange experiences in the integration of scientific research and production. In March of this year, a national meeting held by the State Economic Commission and the State Commission on Restructuring the Economic System on economic structural reform conducted a special study on the question of horizontal economic integration. Later, the State Council promulgated the "Regulations Concerning Certain Problems in Promoting Horizontal Economic Integration." The integration of scientific research, design, and production also underwent great development as a form of horizontal economic integration goes far beyond the limits of technology contract and technology agreement relationships. The integration of scientific research, design, and production has been firmly established at different levels and in different forms to combine the economy and technology into an integral whole. Some of these forms, though small in number, still need improvement. However, it is obvious that they, as a whole, have great vitality and should be strongly supported.

1. The research units mainly engaged in technology development have become the technology development centers of large enterprises or enterprise groups they have entered. Organizational integration is thus achieved. These centers still maintain their economic status of independent accounting and their decision-making power. The large enterprises have markedly raised their standards of production technology and increased their competitive power by making use of these technology development organs. For example, the Changchun Automobile Institute, which is directly under the Ministry of Machine-building Industry which integrated with the First Automobile Plant in 1980, has become a regular member of the First Automobile Production Group. For 5 years, the plant and the institute have jointly improved many old models of vehicles, developed many new products, and upgraded the Jiefang trucks. During the Sixth 5-Year Plan, the automobile institute obtained 14,270,000 yuan from grants of scientific research funds and other allocations. From the automobile plant, it obtained 34,340,000 yuan for technology development and the purchase of equipment, in addition to a stronger specialized technical force. In 5 years, the number of engineers increased 1.71-fold.

2. The enterprises and research institutes have established joint enterprises mainly for the development of new technologies. The profits shared are proportionate to the amounts invested by each party in the form of fixed assets, funds, and technologies. These enterprises rely on the backing of the research institutes and have a great potential for technology development. They produce and develop new products that can be produced only in small numbers and with great difficulty but are urgently needed in society, and thus fill many gaps. For example, the steel-pipe plant established by the Beijing Iron and Steel Research Academy of the Ministry of Metallurgical Industry and Haidian District has solved the problem of producing alloy steel pipes of special shapes, some of which had to be imported for aircraft maintenance.

3. Research institutes have served small and medium-size enterprises that lacked the capacity for technology development. For example, the Coal and Ferrous Metal Research Institute, which is integrated with more than 20 enterprises of the same trade, is now serving these enterprises in technological transformation and importation. These enterprises have made their reputation in this trade, thanks to the institute's service. After further development, research institutes of this type may become the technology development centers of regions or trades. They will not receive operating funds from the state because all the funds are provided by the enterprises, which will also share their technological achievements.

4. Design academies or research institutes have taken the initiative in associating with some enterprises to form companies undertaking complete technical or engineering projects, including designing, construction, installation, and equipment testing and readjustment, in other words, they hand over to the customer the key to the whole project. For example, the Luoyang Petrochemical Engineering Company (formerly the Luoyang Design Academy of the Petrochemical Industry Corporation) was contracted to import the entire Jiyuan Refinery with a 5 million ton capacity in Henan. This type of company makes it possible for traditional industries to adopt complete sets of new technologies in transforming their traditional means of production and undertaking new projects. It helps them complete the projects within the stipulated construction periods,

lower their construction costs, and increase their overall capacity for manufacturing equipment and undertaking engineering construction. It can also help solve the longstanding problem of the dislocation of scientific research and design.

5. Some science and technology personnel have formed civilian companies, using mainly new technologies for technology development, technological service, and technological trade. For example, there are now more than 40 microcomputer sales and service companies in the Haidian District of Beijing, and 16 of them are fairly large ones. In 1985, these larger companies had an output value of more than 123 million yuan, 11.8 percent of Haidian District's gross value of industrial and agricultural output. A special characteristic of these companies is that they have the support of scientific research bases and a technical workforce, in addition to the advanced know-how, lower average age, and easier mobility of its personnel. Therefore, it is good at collecting production and other economic information, flexible in operation, and strong in adaptability.

6. Fund sources, technical and economic information organizations, and consultation services of various types are now emerging as new industries. For example, the Shanghai Industrial Technology Development Foundation was formed with locally raised funds and bank loans. In the first half of 1986, it put out 18.32 million yuan as preferential loans for science and technology and as risk investments.

These forms of integration have pointed out the right direction for us, not only to solve the problem of dislocation between science and economy through organizational structures but also to create a good environment for the rational flow and full utilization of talents.

IV. Great Deal of Work Done in Reforming the Management System of Science and Technology Personnel

Two supplementary documents concerning personnel have been issued since the promulgation of the decision to reform the science and technology system. One of them is in the form of a notice concerning the rational flow of talent, and the other contains regulations on the continued utilization of retired science and technology personnel. The regulations concerning concurrent posts for science and technology personnel were submitted to the Legal Bureau of the State Council in August, and solicitations for comments have been circulated twice. These regulations are expected to be brought up for discussion in the State Council soon.

The following three major tasks were undertaken last year:

1. Reform of the system of title evaluation and adoption of the system of employment for science and technology posts.

Reform of the system of title evaluation is important for the system of science and technology personnel management. The difficulty of this reform is no less than that of wage reform. Since the experiments in some units last year, the reform has been developing gradually throughout the country this year. In consideration of China's financial resources, and the society's ability to bear

the pressure, this reform is being conducted only at the provincial and ministry levels and among the units directly under the central government in the fields of scientific research, education, and public health. As shown in some units where the reform has been completed, such as Qinghua University and the Chinese Academy of Sciences, adoption of the system of employment for science and technology posts has produced some success in improving the internal structure of the personnel and promoting the flow of talent. However, because of the lack of supportive measures in the society and the absence of an environment that is large enough for the flow of talent, many problems still remain in employing professional and technical personnel.

2. On the rational flow of talent.

Since the "Notice Concerning Promotion of the Rational Mobility of Talent" was issued by the State Council this year, the central authorities have once again clearly confirmed the rational flow of talent as their main orientation. This notice has played a positive role in unifying understanding, promoting the reform, and encouraging the flow of talent. Many provinces and municipalities have also worked out similar regulations in light of their own regional characteristics, and have gained many new experiences in organizing science and technology personnel to help the rural enterprises, small and medium-size enterprises, and poor mountainous areas. For example, Jilin has organized 1,000 science and technology personnel to help the rural enterprises for a term of 1 year, and is planning to do this on a regular basis. Furthermore, there are lively discussions on the theory of personnel mobility, the concepts of freedom for these personnel to choose their own profession, the talent market, the ownership of talent, compensation for talent, and the rational flow of talent. Many comrades have also made good suggestions for the promotion of personnel mobility. The suggestions of Zhao Shilong [9392 2457 7893] of the Shanghai Metallurgy Institute and Zhang Cai [1728 2088], a U.S. citizen of Chinese origin, for example, have been fully affirmed by the leading comrades of the Central Committee.

3. On science and technology personnel holding concurrent posts.

Why should science and technology personnel be encouraged to take concurrent posts? The main reason is that we can make better use of their talents and train them. From a macroscopic point of view, there are also advantages in the development of scientific research and the economy in bringing about a closer relationship between science and technology and production, circulating information, and encouraging everyone to do his best.

The question of taking spare-time side jobs is a sensitive one. The use of their spare time in the work of development and to augment their own income has been affirmed in the decision on reforming the science and technology system. While ensuring the satisfactory performance of their regular duties, the science and technology personnel doing spare-time side jobs are also doing the country and the people a service and should be supported. As a matter of policy, they should ensure the satisfactory performance of their regular duties, and their spare-time activities must not infringe on the technical and economic interests of their units. Provided these two conditions are met, the leading comrades should give them every facility with an open mind so that

these personnel need not do their spare-time jobs secretly. Of course, these spare-time activities should be organized, guided, and reported to the leadership in advance. The irony which now prevails is that less spare-time labor yields greater benefits than what can be obtained from the laborious regular work. This problem may be gradually solved along with the reform in the wage and bonus system and with the levy on individual income taxes.

Despite its initial success, reform of the science and technology system is still confronted with many problems. We must be aware that most people (including myself) cannot meet the requirements of the objective realities of the development of a commodity economy, and their understanding of the Central Committee's principles and policies (regarding, for example, horizontal economic integration, the rational flow of talent, and the respect for knowledge and talent) is still inadequate. The dislocation between science and technology and production has not been fundamentally changed, the organizational structure of science and technology is basically the same, and the system is still sealed off. Furthermore, scientific research organs are still appendages of government departments and the bond of a common destiny has not been formed between them and the national economy. The enterprises also lack the leverage and vitality for scientific and technical advancement. (In Shandong, for example, 2,000 state-owned industrial enterprises, which were included in the budget, could retain only 6.3 percent of their profits to be used as development funds in 1985, and the average share of each enterprise was less than 2,500 yuan. Conditions in other regions are the same.) In the absence of strong measures and policies to promote their integration with the enterprises, some scientific research organs are trying to strengthen themselves by becoming independent units; more and more of them are trying hard to separate themselves from the factories originally running them. The improper distribution of scientific and technological resources is far from improved. Many large academies and institutes are unable to make full use of their excessive backbone elements, while the shortage of science and technology personnel is keenly felt in the light and textile industries and commerce as well as the localities and the countryside. The flow of talent is handicapped by the old system and old concepts, the spare-time side jobs of science and technology personnel are frowned on, and the scientific research organs run by civilians are not as highly regarded as they should be.

Based on these conditions and the expectation that the economic structural reform this year will take a gigantic step forward (by accelerating the separation between ownership and management power, and conducting experiments in the systems of leasing, contracting, and shareholding in a planned and systematic way), the fundamental ideology guiding this year's reform should be as follows: While continuing to consolidate, assimilate, supplement, and improve what we have already gained from various reforms, we should adopt some new measures to suit the development of the situation. First, we should focus our attention on the formulation of the second series of supplementary documents concerning, for example, resignation and arbitration, the scientific and technology personnel sent to support the frontier regions, the care for retirees, and the promotion of the integration of science, technology, and production. Later, we should focus our attention on freeing the scientific research organs and the science and technology personnel.

To sum up:

First, all departments of the State Council should gradually send their scientific research organs down to the basic levels, separate the functions of the government and the research organs, continue to create various forms of horizontal integration, and strengthen the combination of science, technology, and production. The original remuneration and status of the research institutes which have entered the large enterprises or enterprise groups should be preserved.

Second, reform of the system of fund allocation should be accelerated. The operating funds for scientific research should be further reduced by 20 percent.

Third, the policy toward research organs and the science and technology personnel, and the system of their management, should be more flexible.

1. Those scientific research establishments and units that produce poor economic results under inefficient management should be contracted or leased to collectives or individuals, or should be reorganized.

2. We should allow large academies and large institutes of a comprehensive nature with many specialized courses to be broken down into a certain number of units with independent accounting, to be operated in close combination with different trades, enterprises, enterprise groups, or key enterprises. They may also be contracted to collectives or individuals.

3. We should allow science and technology personnel to leave the research organs or institutes of higher learning for the townships and countryside to run small, medium-size, and rural enterprises under contract, or to set up organs for technology development, technological service, technology trading, or various forms of small joint ventures or corporations. Various levels of government and the departments concerned should work out flexible policies for their wages, titles, residence registration, and organizational relationship and support them by granting them credit for science and technology, risk investment, or the purchase of stock certificates, or by giving them favorable tax rates.

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ANALYSIS PROVIDED FOR STATUS QUO ON S&T PRODUCTION GULF

Beijing KEJI RIBAO in Chinese 19 Feb 87 p 3

[Article by Guo Qinghan [6753 1987 3352] and Liu Zhonghe [0491 0112 0735]: "An Analysis of the Reasons for the Current Gulf Between Science and Technology on the One Hand and Production on the Other"]

[Text] In recent years, the restructuring and the policy of opening to the outside have greatly promoted the integration of science and technology with the economy, allowing for a certain improvement in the situation regarding the gulf between S&T and production. But there has not been a fundamental alteration of perspective. Therefore, it is necessary to explore the reasons for the current gulf between S&T and production, as well as the ways to deal with this.

In the entire process that is science research--intermediary links--production, S&T organizations are the producers or suppliers of research achievements; intermediary links touch upon the nodes and bridges between science research and production; production sectors are therefore the requestors or consumers of S&T achievements. In the overall process, these three parts each has its important function, but some of us comrades (and especially comrades in the S&T sector) invariably emphasize the first two links, while neglecting the latter, with the result of a gulf between S&T and production.

From the point of view of economics, consumption or demand is the goal and purpose for production, and to a certain degree this conditions the development of production. The degree of demand by production for technological advancement conditions the degree of integration between S&T and production. When production makes no demands on S&T, even though there may be many S&T achievements, they will only become exhibition items or samples. In contrast, when production makes demands on S&T, this leads to various forms of association and intermediary links between S&T and production.

The enterprise is the basic unit for realizing production, and medium to large enterprises are the backbone and mainstay of production. Overall, in China enterprises are making few demands on S&T achievements, all the more true for state-run enterprises and especially of the medium to large enterprises. Medium to large enterprises seldom patronize the technology markets, and relatively few have established economic and technological relations with

science research organizations. For example, of the more than 320 technology contracts signed since 1984 by the Shanghai Silicate Institute with foreign interests and the 22 S&T--production associations established by it, not one of the partners of association is an enterprise larger than medium size. For another example, of 101 medium to large enterprises in the Wuhan region, only 15 of them bought domestic applied technology achievements, or 15 percent, and only 664,000 yuan in funds were involved. Regarding the counter phenomenon where some enterprises do not actively rely upon S&T advancements (which some call the "anti-technological advancement tendency"), the reasons are chiefly that the enterprises lack the need and conditions for relying upon S&T advances.

1. The internal reasons why enterprises lack a need or the conditions for reliance upon S&T advances are:

They lack the profit motive for S&T advancement.

Profit is the motive for the existence and growth of enterprises. To attain the goal of realizing a profit, they must seek out S&T advances. This is therefore the profit motive for S&T advances. In the past, enterprise units have sought output value and output quantity, and have been satisfied with being able to present their bills to higher authorities without regard to profits and losses, there being no so-called profit motive. Although at present we have to a certain degree intensified the profit motives for enterprises, the bonds that are the soft budgets of the enterprises have not been thoroughly changed, and the influence from the traditional system is quite deep. At the same time, enterprises seeking technological advances invariably take a certain risk, for when problems arise they are themselves responsible. Even when successful, because certain policies "whip the faster ox," the top quality products do not have a corresponding top price, which keeps the enterprise income quite minuscule, greatly weakening the profit motive for seeking out S&T advances.

There is a gulf between the goal of enterprise demand and reliance upon S&T advances.

Some enterprises lack foresight regarding their own long-term growth, and quite seldom respect the S&T advances that have great significance for their long-term growth. Pursuing only the profit that is apparent makes pursuit by enterprises of bonuses and welfare exceed the pursuit of profit. As long as it is possible to sell a commodity, they seldom think of relying upon advanced S&T to improve their market competitive capacity. It is only under conditions where it would be hard to continue otherwise that there is a temporary embrace of the faith, and they seek out advanced science and technology to get over the present difficulty. But once things have turned toward the better, this matter once again falls by the wayside.

There are the effects of traditional customs and old ideas.

For many years now, some enterprises have been accustomed to rely on equipment in seeking higher speeds and higher value, but have ignored the economic

results and product quality; to emphasizing the path of extending and expanding reproduction, while not emphasizing technological transformation and S&T advances; being unwilling to engage in innovative work, especially efforts at technology development; some new techniques and new technologies cannot be applied promptly, invariably because the enterprise chooses to go with the old. All these reasons have restrained the need for enterprises to rely upon S&T advances.

It should also be pointed out that in addition to the factors just described, some medium to large enterprises have generated the idea of sole reliance on imports because of the advanced technology and equipment they have imported from abroad. Consequently, they have ignored the necessity to rely upon domestic and their own S&T strength for developing the technological transformation and for technological development.

2. Enterprises lack external reasons to rely on the demand and conditions for S&T advances:

They lack a reasonable, excellent external environment.

Intense market competition is external pressure for enterprises to depend upon S&T advances. Presently, market mechanisms are progressively making themselves known, but enterprises are far from becoming truly independent commodity production operators. When certain enterprises sustain losses they can achieve a certain degree of compensation or preference in the areas of pricing, tax collection, or credit, and enterprise leaders will certainly not take on any economic responsibilities with this in mind. This greatly weakens the external pressure for enterprises to rely upon S&T advances.

We lack policies to entice and encourage enterprises to rely upon S&T advances.

When similar products have no obvious price differences, the lesser quality will not be accepted and the higher quality has nothing to gain, which does not lead to a competitive situation. At the same time, we lack examination criteria for enterprises regarding a reliance upon S&T advances, and the current primary criteria are output value, output quantities, and profit for taxation. The proportion of new output value and the levels of technological transformation have no concrete examination specifications, which results in certain products being the same for dozens and decades of years. This is of no use for making obsolete those old products that are high in energy consumption, low in quality, and obsolete in style, nor for developing new products in accord with needs.

There is an urgent lack of funds for pursuing S&T advances.

At present, enterprises generally have the authority to retain something less than 20 percent of profits generated. Of the retained profit, aside from that used for bonuses and welfare, the majority is used for the facilities construction of such welfare benefits as housing that which is used for production investment is less, and among those production investments there is very little left for technical transformation or S&T

advances. According to a survey of 101 medium to large enterprises in the Wuhan area, new product development funds from 1985 retained profits were only 0.2 percent of gross output value, and 39 enterprises allocated nothing at all. Even for technology transformation funds that are clearly marked as such, much is put to other uses. Regarding new technology development, lacking preferential loan policies leads invariably to shortages of enterprise funds (especially for loan amounts to carry out macroscopic control and when money is tight), at which times technological transformation and technology development are difficult to implement. .

There is a lack of technical strength and capability for technology development and attraction.

According to statistics, the proportions of various technological personnel among staff totals are: metallurgy industry, 4 percent, industrial chemicals, 3 percent, light industry, 3 percent, machinery industry, 6.3 percent, electronics industry, 8.4 percent, while those people directly engaged in technology development are even more limited. Science research organizations affiliated with national enterprises have 150,000 science research personnel, which is only 17 percent of the number of science research personnel in science research organizations throughout the country. If, for example, we figure on the 400,000 people in industrial enterprises at the county level or above, on the average there are 2.6 enterprises for each science researcher. For technology personnel in small scale enterprises, group enterprises, and township enterprises, that number is even less. It is just because of this that the ability of enterprises to apply and absorb new technology is deficient, and it is difficult for them to make the most of results. For example, the directional magnetic slot developed by the Wuhan High-Pressure Institute is an effective energy conservation device, and in 1984 rights to this achievement were transferred to a plant in that city. But because the technical capability of that plant was insufficient, to this day no product has yet appeared.

To summarize the analysis just given, we believe that if we are to thoroughly turn around the situation where there is a gulf between S&T and production, then we must earnestly implement and carry out the principles and policies of the Central Committee regarding the unleashing of science research organizations and the unleashing of scientists and technicians. For independent research organizations and design units that focus on technology development, these should actively become part of medium to large enterprises and enterprise groups and should bring about the unification of research and production, which will allow science and technology to better cater to economic construction and to serve production; at the same time, we must better attract and intensify the motivation and demand for enterprises to rely upon S&T advances, which will improve the environment and conditions for enterprises to depend upon S&T advances and will allow for a close integration of production with science and technology.

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CSO: 4008/2081

UNIVERSITY S&T JOINT RESEARCH CENTER FOUNDED

Beijing KEJI RIBAO in Chinese 11 Feb 87 p 1

[Report by Sun Shuxing]1327 2885 5281]: "The Institutional Science and Technology Joint Development Center Established"]

[Text] In order to bring together the various different strengths of the higher institutions in China and to coordinate the scientific research activities of relevant higher institutions, the Institutional Science and Technology Joint Development Center was founded on 10 February in Beijing. Thirty-nine domestic institutions of higher education joined the Jiangsu Province Institutional Group and the Shanghai Municipality Institutional Science and Technology Service Center as the first member units.

More than 50 percent of scientists and technicians engaged in high level technology occupations in China are concentrated among the various institutions of higher learning. Because they lack unified organization and coordination, there are at present instances where each does things in its own way, or where there is duplicate development. Establishing the Institutional Science and Technology Joint Development Center will play an active role in overcoming these unfortunate practices.

This Center was built with the approval of the State Science and Technology Commission, has been guided and supported by the State Education Commission, is an independent legal entity, and is not an administratively managed organization for the science research activities of higher institutions. It will contract with each of the member units for business dealings.

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CAS JOINS IN FOUNDING JOINT RESEARCH LABORATORY

Beijing KEJI RIBAO in Chinese 15 Feb 87 p 1

[Article by Du Mingming [2629 2494 2494] and Zhang Fengsha [1728 7685 5446]:
"Joint Research Laboratory Established"]

[Text] In serving economic construction, how is the Chinese Academy of Sciences (CAS) to make the most of its special comprehensive advantages? When the larger enterprises are importing advanced foreign technology, how is absorption, assimilation, and innovation to be taken care of? After years of exploration, the CAS Institute of Photochemistry (Beijing) and the Xiamen Photosensitive Materials Company, Ltd. have chosen the alternative of establishing the Joint Research Laboratory. This joint laboratory was officially founded on 14 February, signifying that CAS's undertaking of high level cooperation with large enterprises has taken a new step.

The Institute of Photochemistry is an institute in China that has a considerable basis and distinguishing features regarding photosensitive chemistry, and its science research strength is quite abundant; the Xiamen Photosensitive Materials Company has in recent years become a rising new large enterprise in China, and will this year enter the stage of test production. If we are to domesticize the production of more than 100 photosensitive materials, this is not something that a company or local institute can accomplish. Therefore, the company has joined with CAS to establish broad lateral relations. All together, CAS has organized more than 20 institutes, such as the Institute of Photochemistry, the Changchun Institute of Applied Chemistry, the Changchun Institute of Optical and Precision Machinery, the Shanghai Institute of Organic Chemistry, the Fujian Institute of Material Structure, and the Chengdu Institute of Organic Chemistry, to help the Xiamen Photosensitive Materials Company do research on relevant materials; CAS has also provided a great deal of support to this company in terms of manpower, transferring in all some 60 key scientists and technicians in this company. For the past 2 years, both parties have cooperated in gaining outstanding results, and both have benefited. However, in order to allow photosensitive materials from China to enter the advanced ranks of the world, we must also have some way of maintaining long-term full-scale cooperation. Therefore, through exploration and full negotiations, they have chosen the alternative of establishing the Joint Research Laboratory.

The Joint Research Laboratory focuses on applications research projects in disciplines needed by the company, where the basic expenses will be shared, and project expenses and bonuses will be paid by the company. Fixed staff at the laboratory is from 20 to 30 people, the lab is part of the Institute of Photochemistry, is administratively affiliated with the Institute, and will be run through the laboratory director responsibility system. Both parties constitute an S&T leading group, which is responsible for project implementation and coordination.

At the foundation meeting, CAS vice president Sun Honglie praised highly this new attempt at restructuring. Relevant responsible comrades from the State Planning Commission, the State Economics Commission, the Ministry of Light Industry, and Fujian Province also praised this new form of association. Lu Jiaxi [4151 0857 6932], specially invited advisor to CAS, said that this signified an upturn for CAS, and that this kind of cooperation would form a diversified "chemical bond," and generate a new kind of "chemical compound."

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IMPACT OF ALLOCATION CHANGES ON RESEARCH UNITS REVIEWED

Beijing KEJI RIBAO in Chinese 31 Mar 87 p 2

[Report by Yu Jing [6657 7234]: "Restructuring of the Allocation System Has Brought About Changes in Research Units"]

[Text] This reporter has learned from relevant departments of the State Machinery Commission that of 64 research institutes and academies formerly directly affiliated with the Ministry of Machine-Building Industry, 34 have completely eliminated [state] funding and have implemented economic independence. The remaining developmental institutes have also reduced funding to some degree. Institutes in social services are all under contract systems. The look of institutes and academies has undergone a fundamental change.

The restructuring has changed the outlook of scientists and technicians. Scientists and technicians have come out of their "ivory towers," have gotten rid of their disdain for production and for operations, and are looking favorable upon a hierarchical concept. This is a change from concern only for papers and for experiments to seeking research topics motivated by the realities of production, and that will quickly transform research achievements into production forces. Research units have also changed from research models to research-production-operation models.

The restructuring has allowed research institutions and academies to take the initiative in serving economic construction. Research-production associations of different forms have sprung up in great numbers. In recent days, more than 100 research-production association organizations have appeared among directly affiliated institutes and academies. Some institutes have become technology development centers for enterprises, and some have joined enterprises or enterprise groups. Both loose and tight associations have their advantages. The Dalian Combination Machine Tools Institute brought together 43 enterprises in the machine tool industry to open up new fields for combinational machine tools in this country. In all, they have developed 950 universal parts to 4,750 specifications for combinational machine tools to constitute complete service that goes from technique, design, manufacturing, and debugging to using "interlocking keys."

The restructuring has allowed the quantities and levels of the research achievements of these institutes and academies to improve constantly, and the

dissemination and application rate has reached 80 percent and beyond. A group of research achievements has been born that is of domestic and internationally advanced levels, achievements such as key equipment for carbon dioxide compressors in the (520,000-ton urea) large-scale machinery complex, the domestically largest and most advanced automatic high-order solid depository, the automatic control system for the Yingkou coal dock unit equipment, the vertical shaft drilling machine, etc., all of which have filled domestic voids, solved problems in economic construction that urgently needed resolution, and that have saved large amounts of funding and of foreign exchange for the state.

The restructuring has invigorated the institutes and academies, and their income has been greatly augmented. In 1986 alone, the net income for directly affiliated research institutes and academies reached more than 120 million yuan, a sixfold increase over 1982. Both research conditions and the lives of scientists and technicians have been improved, and longstanding problems with money, housing, and children have been resolved.

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CSO: 4008/2114

LEASE, JOINT-STOCK SYSTEM FOR RESEARCH INSTITUTES SUGGESTED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 87 pp 8-9

[Article by Ma Xiliang [7456 1585 5328] of the Science and Technology Commission, Lianhu District, Xian, and Hou Yuanzhi [0186 6678 1807] of the Xian Metallurgy Construction Academy: "Lease and Joint-stock System Should Be Experimented with in Science Research (Academies) Institutes"]

[Text It will discover some means to combine the interests of the state, the collective, and individuals in serving the reform of research (academies) institutes:

- It will help affirm the position of scientists and technician as masters of the country on an economic foundation;
- It will help improve the distribution system in the research (academies) institutes so that with distribution mainly based on work done, and supplemented by distribution according to the number of stock shares, personal income will be linked with business results.
- It will help solve the research (academies) institutes' problem with funds, and exercise external leverage as well as become an internal driving force for these academies and institutes.

I. Experiments in Lease and Joint-stock Systems As an Urgent Need for Invigorating Research (Academies) Institutes

The key factor in reforming the science and technology system is to revitalize the scientific research organs, since most of them do not have the required vitality now. On the one hand, the problem of their decision-making power has not been solved. In some cases, this power is in inverse proportion to the amount of operating funds allocated by the higher authorities. On the other hand, most of their personnel pay no attention to the development of their own units; they are more interested in their spare-time research activities than in their own units' development. The cause of this problem is the structure of the research organs' ownership. Most of China's research organs are owned by the state, and yet the reform calls for their transformation into independent entities for research and development. Thus the following contradictions are inevitable.

1. Since the property and funds of the research organs belong to the state, and management power is exercised by the research organs, the result is a separation between ownership and management power. Although the director of the research (academy) institute is nominally the agent of the state with regard to the means of production, he nevertheless stands on the side of the workers and staff members of the research units, all striving for immediate and partial gains and neglecting the long-range interests of the state or the research organs. Thus the state, as the owner of the property and funds of the research organs, has no one to represent its interests in these organs. Its "personification of funds" is actually meaningless. Although the research organs are given greater decision-making power and are, as a matter of policy, permitted to use their own revenues and loans to buy their own equipment, the addition to the fixed assets still belongs to the state. This "antinomy" has restricted the enthusiasm of the research (academy) institute to increase fixed assets.

2. Because all the properties of the research (academy) institute are owned by the state, an organic relationship does not exist between its achievements and remuneration. Consequently, it is hard for them to strengthen their sense of responsibility as masters. Since they do not feel that they are really the masters of the research (academy) institute, they wittingly or unwittingly find themselves in the position of hired hands and lose their enthusiasm in serving economic construction.

3. The compensated transfer of the research (academy) institute's scientific and technological achievements has only changed the source of funds, but not their ultimate possession. Only in name does this income belong to the research (academy) institute; in fact, most of it goes to the state. The increase in funds from this source cannot arouse the enthusiasm of the science and technology personnel.

4. The transformation of technology into commodities and the new system of fund allocation has given some external leverage to the research (academies) institutes, but not the internal driving force they need.

If the structure of ownership is not reformed, the problems of interests, responsibilities, incentives, and motivation cannot be easily solved. Such a reform is the key to revitalizing the research (academies) institutes, and an important way to conduct it is through experiments in the lease and joint-stock system.

II. Experiments in Lease and Joint-stock System for Research (Academies) Institutes Visualized

Basic principles behind the experiments in the lease and joint-stock system:

1) Experiments in the lease and joint-stock system may be conducted among all state-owned scientific research establishments engaging in technology development at the national and local levels. 2) The original names, affiliations, and the owners of funds and fixed assets of the research (academies) institutes doing these experiments, as well as the status of workers and staff members in

state-owned units, will remain unchanged. After being leased to a collective, the newly earned profits should go to the collective, and the new employees should be hired under contracts. 3) The research (academies) institutes, as independent producers of technological commodities under the lease and joint-stock system, should exercise independent management, assume responsibility for profits and losses, pay taxes according to the regulations, and adopt the financial and taxation systems and management system that are required for collective industrial or commercial enterprises. 4) These research (academies) institutes should raise and develop their funds by means of spin-offs, awarding shares, subscriptions, and public sales. Spin-off means converting original fixed assets and funds into shares for the state. Awarding shares means distributing their net income from technology transfers and technology service among the science and technology personnel in the form of stock certificates with the understanding that these personnel should also share dividends as well as losses and that they can continue to share dividends after retirement or death. The stock certificates can also be transferred, sold, or inherited. Subscription means the voluntary purchase of shares by the research (academies) institutes' own personnel. Public sales mean the sale of shares to the public by the research (academies) institutes. The shares subscribed to by the personnel and sold to the public entitle their holders to share dividends and bonuses. 5) Research (academies) institutes under the lease and joint-stock system should practice democratic management and exercise decision-making power in distribution, guided by the principle of socialist material benefits. There must be a combination of power, responsibilities, and interests; of the interests of the state, the collective, and individuals; of immediate and long-term gains for the workers and staff members; and of distribution according to work and distribution according to the number of shares.

Methods of Distribution Under Lease and Joint-stock System

1) Research (academies) institutes under the lease and joint-stock system should pay rent to their departments in charge or the local science and technology commissions under the lease for the use of fixed assets and circulation funds, or, in other words, the use of the state's shares. In principle, such payments should be based on bank rates. Since China's research (academies) institutes are usually short of funds, the amount of payment may for some time be converted into state shares so that the funds can be retained by the research (academies) institutes as development funds. However, such funds must not be used for bonuses or public welfare. 2) Since the research units' revenues from technology transfers need not be taxed for the time being, the net revenues of a purely technical nature in the research (academies) institutes under the lease and joint-stock system should be used as public accumulation funds, public welfare funds, labor bonuses, shares for their workers and staff members, and share bonuses. The public welfare funds can also be converted into stock shares to be awarded to the workers and staff members according to their contributions, or they can be transferred to the development fund at the unit's discretion. 3) Distribution of share dividends and bonuses. For those shares subscribed to by the employees or sold to the public, the dividends can be paid at the agreed-upon rates, while the bonuses will depend on the profits made by the unit. Dividends are to be paid out of the cost of scientific research, while bonuses are paid out of the net technical income after the appropriation

of various funds. For the awarded shares which carry no dividends, the bonuses or losses should be shared according to the unit's business conditions at the end of the year. 4) Distribution and transfer of stock certificates. The regulations concerning the subscription to shares by the science and technology personnel and by the workers and staff members can be formulated according to the unit's decision. The sale of stock certificates to the public should be in accordance with the relevant regulations and after approval. These certificates can be inherited, transferred, or used as mortgage collateral. They can also be bought and sold on security markets according to regulations.

Regulations on Application for Lease of Research (Academies) Institutes

The lease of experimental research (academies) institutes should be arranged by the departments in charge through public bids or through application by the representative of the prospective lessee. The department in charge should also be responsible for examining the qualifications of the lessee's representative. Before the lease, there should be a liquidation of the research (academy) institute's property and funds. The lease contract should be signed by the department in charge and the lessee's representative according to the requirements of the "Economic Contract Law" and should clearly stipulate the rights and duties of both parties. The lease term is generally 3-5 years, but it must be at least 1 year. The lease contract should be submitted to the relevant departments for examination and approval and then notarized, and no party can unilaterally abrogate it or alter its provisions.

The lessee can be a collective of leading cadres of a leading body as well as individual science and technology personnel or a collective voluntarily formed by them. A collective of lessees should elect their own representative.

Administration of Research (Academies) Institutes Under Lease and Joint-Stock System

1. After the notarization of their lease contracts, the research (academies) institutes under the lease and joint-stock system become legal entities.
2. After the experiment of the lease and joint-stock system, the departments in charge, to which these research (academies) institutes are related either by organizational affiliation or in work, can only exercise indirect control over them instead of assigning them any mandatory plan or directly interfering with their business activities.
3. The research (academies) institutes under the lease and joint-stock system will have a managing director assuming full responsibility under the leadership of a shareholders' board of directors. The board of directors is elected by the science and technology personnel and the workers and staff members on the basis of their share rights or number of shares. The department in charge may nominate the representatives of the state's interests to serve on the board of directors. In a research (academy) institute under the lease and joint-stock system, the board of directors is the supreme organ for decision making, and the managing director of the research (academy) institute, as its legal representative, has to be appointed by the board of directors. The appointment must be reported to the higher authorities for the record. The system of holding the managing director responsible for the attainment of objectives set during his tenure will be adopted.

BRANCH ACADEMY ACTIVELY SUPPORTS CONTINUING S&T EDUCATION

Beijing KEJI RIBAO in Chinese 21 Feb 87 p 2

[Report by Deng Xianchun [6772 6343 2504]: "Chinese Academy of Sciences, Chengdu Branch, Actively Develops Continuing Education"]

[Text] The Chengdu Branch of the Chinese Academy of Sciences (CAS) is actively developing continuing engineering education, and in recent years has trained a total of more than 5,300 scientists and technicians and staff, and 60 percent of the personnel at the branch academy have received training to varying degrees.

Since the Chengdu Branch of CAS was established in 1978, in addition to setting up education, it has concentrated on continuing engineering education. Their primary methods have been:

-- They have established training bases. In all, the Chengdu branch has set up foreign language training sites in Chengdu and a Chengdu Branch Academy staff college, at which they have held 62 high level and medium level classes in foreign languages and computer classes, and at which they have trained more than 1,000 people. They have held 9 electronics classes and 11 professional classes. One hundred five people have gone abroad for further education after training in foreign languages at the branch academy, and they have been sent to 11 countries. One foreign language student among them ranked first throughout the country in the 1984 TOEFL test. In training now for 5 years, Guo Jiacheng [6753 0857 6134] of the Chengdu Institute of Biology has published nearly 10 papers, and the piece he wrote entitled "Research on In Vivo Plant Genetic Breeding of CoPr Irradiated Wild Cabbage-Type Tea Oil Trees" has been selected for collection by the United Nations Committee for the Peaceful Uses of Atomic Energy.

-- They have adopted various methods of running classes. The Chengdu Branch Academy has adopted seven integrations in its training classes: the integration of teaching and research, the integration of organized classes with self study, the integration of basic and specialized knowledge, the integration of general improvement and specific training, the integration of surplus labor and second jobs, the integration of institute management and academy management, and the integration of concentrated study after completion of projects with study as projects progress.

-- They have paid close attention to the training of leaders. Beginning in 1981, in its continuing education the Chengdu Branch Academy gradually placed the focus of education onto the training of leaders in particular disciplines. The timely bringing of new knowledge, new theories, new technologies, and new methods as supplements to leaders in particular disciplines creates for them the conditions in which to read, to study, and to exchange with others.

-- They are implementing directional complementary training. Each institute of the Chengdu Branch Academy has done a universal survey of the vocational situations of scientists and technicians, and they are doing directional training in accordance with individual situations. The staff college of the branch academy has courses in each profession, and all first do investigations and forecasting. In addition to the specialties of electronics, mechanics, instruments and devices, and biochemistry, in accordance with the actual conditions of the branch academy they also have science and technology management, financial accounting, and S&T literature specialties, through which they train and send out a group of skilled personnel for all the institutes and plants affiliated with the branch academy.

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TECHNOLOGY IMPORT COMPANY TO GET INTO TECHNOLOGY EXPORTS

Beijing GUOJI MAOYI in Chinese 3 Feb 87 p 1

[Text] "From now on, the China National Technical Import Cooperation (CNTIC) will become innovators for technology export, and will get involved with technology exports as quickly as possible." This was proposed by Zhang Haoruo [1728 4110 5387], deputy director of the Ministry of Foreign Economic Relations and Trade, at a recently held CNTIC cadre meeting.

Zhang Haoruo said that technology exporting is a directional strategic mission, on which must be expended great efforts to get on track. Through technology exporting, we can bring about the export of entire sets of equipment, as well as the export of electromechanical instruments, which would have great significance for altering China's export commodity structures and for stimulating our domestic technology development and advancement.

Zhang Haoruo mentioned that there will be competitive thinking conceptually, and they will rely for success upon the quality of work, high efficiency, and top-quality service; with the concept of serving society, this will not only look toward the economic results of the company, but also toward results for society. This will require that we set up a contingent that is cognizant of the building of a spiritual culture, that is idealistic, that respects discipline, and that is strong in technology trade.

CNTIC manager Xu Deen [6079 1795 1869] said that in order to meet the demands of the restructuring of the economic system, the company staff must implement changes in six conceptual aspects. One is to promote the concept of active competition, to eliminate the idle thinking that stuck to the old ways, and to be bold in seeking innovation and dare to take risks; a second is to firmly establish the concept that "where the customer is concerned, service is first," getting rid of the spirit of "bureaucratic commercialism" and "shopkeepers"; a third is to establish the ideas of concerted growth and joint progress, getting rid of the traditional concepts of self-centeredness and unilateral decision making; a fourth is to advocate the overall concept of concerted efforts and a sense of responsibility as being the master of one's own affairs with the enterprise as one's family, in opposition to each doing things in his own way and having every shade and hue of the hired-hand mentality and individualism; a fifth is to establish the new concept of modern scientific management and getting rid of the tendencies for doing things in crowds and by hand; a sixth

is to promote a spirit of solid work, with arduous struggle and building up of the country through thrift and hard work, and by opposing extravagance and waste and spendthrift ways that take no heed of economic accounting.

It is said that during 1986 CNTIC was foremost among technology trade throughout the country, when it had import transactions of nearly \$3.1 billion and incoming goods worth more than \$2.5 billion; the value of technology export transactions was nearly \$1.8 million, with an income in foreign exchange of \$600,000.

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EFFORTS NOTED FOR INCREASING TECHNOLOGY EXPORTS

Beijing KEJI RIBAO in Chinese 30 Mar 87 p 1

[Report by Chen Xiaoling [7115 2556 7117]: "China Will Further Develop the Business of Technology Exports"]

[Text] Recently, this reporter learned from the Ministry of Foreign Economic Relations and Trade of a rising new business in China for generating foreign exchange through exports--efforts at technology exports have begun. According to incomplete statistics, last year 20 items were contracted for technology export in transactions between China and foreign interests, the volume of that trade being more than \$20 million.

This country has a great potential for technology exports, and the prospects are vast. The new China has been in existence for more than 30 years, and this country has laid a rich industrial, scientific, and technical foundation. We have many mature industrialized technologies, have mastered quite advanced design and technique technology in certain fields, and many of our inventions and creations have won prizes internationally. But for quite some time now, because people have had a poor conception of the value of technology, in addition to that the fact that organization and management efforts have not kept up, technology exports in China have never been placed on current agendas. Many technologies have been given free to people through various means. Foreign technology trade has fundamentally been stagnant.

With the flourishing in recent years of the domestic technology markets, the concept that "technology is also a commodity" has gradually been acknowledged, and making the most of the function of technology commodity exports in generating foreign exchange has become an inevitable trend for growth.

In October 1986, the State Council made an official reply to a request for instructions by the Ministry of Foreign Economic Relations and Trade and the State Science and Technology Commission regarding the opening up to foreign technology markets and the strengthening of technology exports management, the effect of which has been to officially include technology exports on the same track as foreign trade. Many areas and departments, as well as companies dealing with technology exports, are now actively organizing sources for goods, are striving to open up markets, and have adopted various formats for expanding technology exports. Currently, primary export items include such

things as a sprayed-coal-dust technology for blast furnaces, a rubberlike butadiene styrene block copolymer technology, a microwave electron tube design and manufacturing technology, tire manufacturing technology and equipment, an oxidized yttrium production technology, and the production technology and equipment for hemp bags and woven bags. The target of the exports are primarily Brazil, Italy, Iran, the GDR, and Burundi.

After efforts over several years, technology exports from this country will be a channel for the creation of foreign exchange that cannot be ignored.

Currently, relevant departments are doing further research on formulating complementary policies and relevant methods to promote the growth of the technology export business.

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CSO: 4008/2115

SUCCESS IN OVERSEAS CONTRACTED LABOR MARKET REPORTED

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 23 Feb 87 p 3

[Text] The Ministry of Foreign Economic Relations and Trade (MFERT) is requiring that in this new year all relevant companies develop hierarchical, multi-profession labor exports to strive to export high-tech labor in the areas of prospecting, design, and planning.

For 1986, China's record for contracting out labor abroad was outstanding, and was the best year for economic results since we entered the international marketplace in 1979. According to statistics from MFERT, in 1986 various companies in this country contracted for a total of 1,400 projects and labor cooperative contracts abroad, which was a 6.4 percent growth over the 794 projects of 1985. The volume of those contracts was \$1.27 billion, up 6.7 percent over the \$1.19 billion of 1985; business volumes at \$943 million were up 4.8 percent over the \$900 million of 1985.

MFERT pointed out that in 1986 the growth of China's foreign contract labor market was more balanced than in the past, and that there were improvements in distribution, which reduced the risks to the various companies in this country in the contracted labor market and kept reductions in the market of a particular area from affecting the total picture.

According to one analysis, in 1986 the international contract labor market would once again fall into a state of depression, and competition between the companies of all countries would be fierce. That China was able to achieve such a good record was primarily because each company persisted in implementing the operational principle of "safeguarding savings, maintaining quality, small profit, and respect for the equitable." They played close attention to cash projects and to strengthening operations management, and at the same time each company made what the contracting labor personnel had coming to them dependent upon the results of the project and income to the company, which motivated the enthusiasm of everyone.

The MFERT Foreign Economic Cooperation Department Director, Wulanmulun, indicated that there are still many difficulties in developing China's foreign contracted labor undertaking, and that on the basis of knowing the difficulties, in 1987 each company would adopt the most flexible means to open up even broader world markets.

EFFECTS OF NEW S&T RESTRUCTURING POLICIES EXPLORED

Beijing KEJI RIBAO in Chinese 30 Mar 87 p 2

[Report by Han Yuqi [7281 3768 3825] and Li Renqin [2621 0088 6024]: "The 'Dual Unleashing' Brings a Thriving Vitality"]

[Text] From the latter part of February through the first part of March, units of the Leading Group for Scientific Work of the State Council, the State Science and Technology Commission, the State Economic Commission, the Commission of Science, Technology, and Industry for National Defense, and the Ministry of Agriculture, Animal Husbandry, and Fishery formed a joint investigative group, and went to Jiangsu, Hubei, Sichuan, and the northeast to undertake an investigation of the promotion of the restructuring of the S&T system. At the places they went they saw the spirit of the integration of science research with production as mentioned in the two documents of the State Council, i.e., the "Some Resolutions Regarding the Further Promotion of the Restructuring of the Science and Technology System" and "A Resolution Regarding the Promotion of the Incorporation of Science Research and Design Units Into Medium to Large Industrial Enterprises," which have elicited an enormous response from all provinces and municipalities. They also saw the concern of the many research organizations and scientists and technicians for the "dual unleashing," they saw the thriving vitality that the restructuring has brought to the battleground of science and technology, and on and on.

The Restructuring Has Become a Topic of Conversation in All Aspects of Life

There was a clear feeling in every survey group: the two documents of the State Council have jolted province and municipality leadership, the science research organizations, and scientists and technicians.

Reaction from comrades in Heilongjiang Province was that there had appeared on the battlegrounds of science and technology a new aspect of vital thinking, and everywhere they went, whether it was comrades of S&T administrative management departments or leaders from research organizations or scientists and technicians engaged in scientific research, design, medicine, and teaching, all were concerned, were discussing, and thinking of questions to ask. This produced the phenomenon of unprecedented concern for the restructuring. Many people said, "In this occasion of restructuring, the central authorities have certainly gotten it right."

No Longer Is the Restructuring of the S&T System the Sole Affair of the S&T Commissions

After the promulgation of the two documents by the State Council, many provincial and municipal leaders placed the problem of the restructuring of the S&T system onto the agenda. The Nanjing municipal committee convened the standing committee, listened to reports from the municipal S&T commission, and then held a meeting of 3,000 people to transmit the two documents of the State Council. Then the municipal committee arranged for the departments of finance, taxation, industrial and commercial administration and management, banking, and personnel affairs to draw up jointly with the S&T commission an implementation program for the restructuring of the entire municipal S&T system. They also sent people to Beijing to request to be an experimental city for the restructuring. The municipal party committee secretary stated it clearly: "This undertaking of a 'dual unleashing' has as its goal the invigoration of the Nanjing regional economy, and it is not intended to make the city of Nanjing itself prosper. We will be certain not to divide up the region, but rather will base ourselves in Nanjing as we cater to the entire country."

Many cities have been unwilling to lag behind during this restructuring. Many other cities have taken the initiative in showing their desires to be experimental cities for the restructuring, among which were cities to which the investigation group did not go, as, for example, Guangzhou.

Restructuring Programs With All Kinds of Features

In order to implement the two documents of the State Council, many cities have their own ideas.

With Deputy Mayor Hong Qipeng [3163 0120 7720] in command, Harbin organized the S&T commission, the economics commission, and the planning commission to jointly draw up a plan. On the basis of the "Some Provisions Regarding Full Utilization of the Scientific and Technical Advantages of State and Provincial Affiliated Units" and "Details for the Implementation of Expanded Autonomy for Institutes" that they had originally drawn up, they also formulated the "Provisional Resolutions for Encouraging Scientists and Technicians to Leave Their Positions, To Remain at Their Positions Without Salary, to Contract to, Hire Out to, Lead, and Set Up Enterprises, Township Enterprises, and District Enterprises," the "Provisional Resolutions for Harbin Municipal Civilian-Run Natural Science Research and Development Organizational Management," etc., which offer many preferences in the areas of housing, wages, child employment, and taxation.

In its experimental site plan, Nanjing Municipality is using economic levers: it has included advances in enterprise technology in the goal of factory director accounting over his term of office; 1 percent of enterprise sales volumes will be for a technology development fund; and 5 percent of profits from sales during the first year a new product is in production will be for bonuses, not to be included within the total allotment for bonuses. The Nanjing deputy mayor said, "We are seeking to be a national test site, and we

ask not for money or projects from the state, but for policies." Other mayors said, "Our desire to be a test site is for information, not to be a 'special dining hall'."

The Various Models for the Integration of Science and Technology With the Economy

How are science and technology to be integrated with the economy? This is a central matter for the restructuring of the S&T system. The investigation group discovered that there are many models springing up in many cities, and that science and technology is a driving force for enterprise growth, the function of which is more and more clear.

Changzhou, Jiangsu, this city where the restructuring and open doors were earlier than elsewhere, already has many models for the integration of science and technology with the economy.

The plant-institute conglomeration model: There are 54,000 scientists and technicians throughout the city of Changzhou, 90 percent of whom are in factories. The plant-institute conglomeration reflects the great need industrial factories have for technology. As for example the Changzhou Municipal Computer Plant Institute and the Changzhou Radio Main Plant Institute, where each year they can develop several new products for the industrial factories. They can even take on much research and development for high technology products, and have become technology reserves for enterprise growth.

The science research forerunner model: The Changzhou Institute of Chemical Engineering has joined its own advantages in its capacity for the research and development of new products with the Changzhou Auxiliary Plant. The plant is subordinate to the institute, and is the first experimental industrial plant for the institute. The plant director is appointed by the director of the Chemical Engineering Institute, and rights to the research achievements of the institute are transferred constantly to the plant to be put into production, which promotes the growth of production and improves economic results. Each year, 20 percent of the pretax profits of the plant are turned over to the institute, and because of this both the institute and the plant have grown considerably.

The close integration model: The Changzhou Agricultural Machinery Institute has formed a research-production association with the Changzhou municipal Diesel Engine Plant for the joint development of new products. The plant has provided 3,000 yuan of yearly funding per person to the institute, and the institute then renews products for the factory and serves its technological transformation. In addition, the plant provides the institute with expenses for special research in accordance with contracts. In keeping with the principle of the distinction between ownership and rights of usage, the plant also provides the institute with a processing center and equipment. The plant and institute are each independently accounted, and the subordinate relation with the institute does not change, the nature of ownership does not change,

and the allocation system does not change. At the same time as the institute of Agricultural Machinery is completing the development tasking provided by the plant, it may also establish lateral associations with other units.

The merging with enterprises model: The Changzhou Bicycle Institute merged in November 1985 with the Bicycle Main Plant, and merged with the technology office of the Main Plant into the Technology Development Section, and the plant will turn over one experimental plant for this science management to form a system that is complete in research, development, test production, and batch production.

In summary, promulgation of the two documents from the State Council has pointed out the directions for the integration of science and technology with the economy. All areas are currently actively investigating just how to specifically do all this and what models to use. Even though from now on we must formulate corresponding complementary policies, all departments must still be coordinated and old concepts must still be eliminated. However, it can be seen that the integration of science and technology with the economy is the ways things are going, and that it is progressing step by step.

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SUCCESS OF S&T DEVELOPMENT COMPANY DESCRIBED

Beijing KEJI RIBAO in Chinese 30 Mar 87 p 2

[Report by Ji Hongguang [1323 3163 0342]: "A New Technology Development Company Breaks Through in Force"]

[Text] In the heart of Zhongguancun that is the electronics street in the capital, a new technology-development company that has been founded by the Institute of Computing of the Chinese Academy of Sciences is making a forceful showing. Two years ago this company had only 200,000 yuan in funding, 11 technicians, and an old reception office as a company, but today has become a high-technology company with operations worth more than 17 million yuan. Zhou Guangzhao, newly appointed president of the academy, praised their efforts: "You are making a worthwhile exploration on behalf of the science and technology system restructuring."

This reporter came to understand at the founding of a users group for the "association-mode Chinese-character systems" held on 25 March that the reason the company run by this firm can be in such an inviolable position in the fierce market competition for computer technology is that they adhere closely to the technology advantage they have within. And they are always thinking of the users, and will be successful through their reputation.

In 1985, after the founding of this company, faced with a situation in this country where the rate of usage was universally low for the more than 200,000 computers that had been purchased and brought into the country, they exerted much effort to develop the key product that is an association-mode general purpose Chinese-character card for microcomputers. Because of its superior performance, ease in learning and usage, and abundant software, more than 17 million of this product have very quickly been sold in 29 provinces and municipalities throughout the country and in Hong Kong and Singapore. It has also twice received the highest awards in evaluations with similar products. After the Beijing Jeep Co., Ltd., used this system in its production management, test production of the new model Jeep went smoothly, its introduction being 10 months ahead of schedule.

Even more valuable is the fact that after this company sells its product it continues to modify it in accordance with problems and requests from users.

It is currently in the sixth version, and has formed a product series. And it is provided to users in a timely manner.

At the suggestion of users, they also established a Chinese-character card users group to enhance relations with users, and to allow users to monitor the quality of their service.

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INCORPORATION OF S&T UNITS INTO ENTERPRISES DISCUSSED

Beijing KEJI RIBAO in Chinese 12 Feb 87 p 1

[Article by Ji Hongguang (1323 3163 0342): "How We Are to Understand the Entry of Science Research and Design Units into Medium to Large Enterprises"]

[Text] The State Council has recently issued the "Resolution Regarding the Promotion of Incorporating Science Research and Design Units into Medium to Large Industrial Enterprises," and many readers who have been concerned about this resolution have posed certain questions. This reporter is grateful for the following responses offered upon interviewing the State Science and Technology Commission and the State Planning Commission:

Question: Will all science research and design units be incorporated in medium to large industrial enterprises?

Answer: No. The science research and design units mentioned in this resolution for incorporation into medium to large industrial enterprises primarily refer to those research and design units that focus on technology development, and especially research and design units in commodity development and commodity design. From the point of view of the state, these units are about 70-80 percent of the independent research organizations in the industrial sector. And those science research organizations engaged in basic research, applications research, and research for the public good are not included in this resolution.

Question: How are we to understand the incorporation of research and design units into medium and large industrial enterprises?

Answer: By this incorporation is meant that in organization the two are truly joined, and that science research organizations must not only assume responsibility for research, design, and professional technology management tasking as commissioned by the state or by departments, but that they will be duty bound to take on technology development tasking from the enterprises. The R&D expenses should eventually be assessed from gross sales volumes for the enterprises, which will gradually reduce their dependence on state allocations. But organizationally they can retain a relative independence, enjoy a certain amount of autonomy, and continue to carry out independent economic accounting. "Incorporation" will not be the same as the merging of the past, nor will it be the loose association that is common these days.

Question: Well then, how is this incorporation of science research and design units into medium to large industrial enterprises different from the factory/institute mergings of the past?

Answer: The incorporation of research and design units into medium to large industrial enterprises will implement a unification of science research with production, and is a better way to resolve the gulf between research and production. As the economic system restructuring and the science and technology system restructuring intensify, the separation of the duties of government and enterprise is imperative, and gradually placing research and design units within enterprises, enterprise groups, and cities having trades and centers will allow state management of science research organizations to change from direct control to primary control by indirect management. Policy guidance and coordinated service is a future direction of the restructuring. This resolution has been proposed with this as a background.

In the past we advocated the merging of plants with institutes, primarily in consideration of affiliation relations, and this did not touch upon questions of autonomy and vitality for the enterprises and research units. Therefore, although we have desired a strengthening of the integration between science and technology and production, for the most part this has not happened. The goal of the incorporation that we are currently proposing is in meeting the needs of a socialist planned commodity economy, and of establishing structures and operational mechanisms that are in keeping with it.

The mergers of the past were a mode in which departments and regions made use of administrative orders instructing a grouping, which contributed to strengthening the restrictions that have placed barriers between enterprises and science research units, and which has obstructed the growth of production forces. In accordance with the needs of enterprises and science research and design units, and based on the principle of voluntary participation for mutual benefit, on this occasion we have used various modes and have not rigidly adhered to a particular model.

Then there is the relative independence mentioned earlier. After independent research and design units have been incorporated into medium to large industrial enterprises or into enterprise groups, they will have a certain degree of autonomy because they will maintain considerable independence. They will be able to continue to carry out independent economic accounting, continue to be responsible for the research and design tasking and professional technology management tasking from the state or from departments, and they will be able to assume research, design, and consulting tasking from outside. This avoids the situation that has occurred on occasion in the past where after the merging of research and design units with enterprises, methods for guiding production were used to guide research, consequently leading to abuses in science research. From this new way of doing things, research and design units can operate in accordance with the rules of science research itself, thereby better avoiding the phenomenon of having the two shells that are science research on the one hand and production on the other. The resolution proposes that those research and design units incorporated into enterprises can only accept tasking from outside if they have first accomplished the tasking for state prescriptive planning and enterprise technology development. This clearly requires that after science research and

design units have been incorporated into enterprises, they will serve the enterprises first of all, which will allow research personnel to care more for the economic results of enterprises and to care more about the transformation of research achievements into production forces as quickly as possible.

Question: Does the incorporation of research and design units into the enterprises make more of a burden for the enterprises, and will this affect the growth of the research and design units?

Answer: This is not likely. On the contrary, there are advantages for both parties. Seeing that the vigor universally present in medium to large industrial enterprises in China at this time is insufficient, the resolution adopts "providing grain rations" and "dowry" methods for the science research and design units. Research operating expenses will be allocated using the first year of the incorporation as a base amount, and this will not be a situation that does not change over 5 years, but rather allocations will be for over a long period. In this way, enterprises will not abandon responsibility for some expenses of the research and design units just because there is a temporary drop in strength. Research and design units will also have their own stable source of funds. At the same time, the resolution also proposes that the remuneration originally enjoyed by the research and design units incorporated into enterprises will not change, and that the funds from the transfer of rights to relevant technologies will be temporarily tax free. Transferring the rights to technology achievements from technology development organizations in enterprises of this sort are also temporarily exempt from taxation, and there need not be the restriction of an income tax levied against income of 300,000 yuan and above from the transfer of rights to technologies of the original enterprise. This way, the enterprises can gain much from this action. As far as the research units are concerned, there can both be short term tasking and also moderate to long term tasking, and also they can use enterprise equipment for intermediate testing, which resolves situations in which the tasking for these units was insufficient and where a number of researchers have had nothing to do. At the same time, this can also benefit arrangements concerning the overall allocations of personnel for both parties.

Question: For those technology development research and design units that cannot be incorporated into enterprises, how can science research and production be integrated for them?

Answer: Units such as those can adopt the following four methods: 1) for those technology development and technology service organizations that would have a great affect on an industry and that have a genuine capacity for industrial service, through careful selection and reconstitution, they can develop into industrial technology development centers; 2) some can orient toward small to medium enterprises to become technology development departments or regional technical service centers; 3) some can join with design and engineering units for form whole technical engineering contracting companies; 4) some can develop into research/production model enterprises.

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EXPLANATION OF S&T ACHIEVEMENT AWARDS POLICIES

Beijing KEJI RIBAO in Chinese 12 Feb 87 p 4

[Article by the Office of Awards, Achievements Administration, State Science and Technology Commission: "A Discussion of Rewards for S&T Achievements in China"]

[Text] Scientific and technical achievements that are the crystallization of the intelligence and labor of scientists and technicians and the broad masses have traditionally been revered by our party and government. The state treats rewards for scientific and technical achievements as a fundamental policy for developing the cause of science and technology in China. In the early years after the founding of the country, the former Government Administration Council issued the "Resolution Regarding the Rewarding of Relevant Production Inventions, Technological Advances, and Reasonable Suggestions." After this, with the approval of the Government Administration Council and the State Council, 10 awards regulations were issued for the areas of basic theoretical research in the natural sciences, research in and the development and dissemination of science and technology, and the renewal of technology. What is currently in effect are four awards regulations issued since 1978 with the approval of the State Council, which are the "Natural Science Award Regulations," the "Invention Award Regulations," the "Science and Technology Advancements Award Regulations," and the "Reasonable Suggestions and Technology Advancements Award Regulations," the first three of which "Regulations" are awards at the national level. S&T award regulations in this country have the following features:

1. They implement the principle of an integration of spiritual encouragement and material encouragement, where the spiritual encouragement is foremost. This induces scientists and technicians to actively seek advancement and to make more contributions.
2. They emphasize the economic and social results of rewarded achievements, elicit the close integration of science and technology with economic construction, and thoroughly implement the principle that science and technology must cater to economic construction, which allows S&T achievements to be fully utilized in science research and production.

The "Natural Science Award Regulations" are to encourage science research achievements of major significance to the development of science and technology, and that elucidate natural phenomena, characteristics, or laws.

The "Invention Award Regulations" are to encourage major new accomplishments in science and technology, which at the same time must possess the three conditions of being unique, advanced, and proven through practice. The scope of awards includes: new equipment, new methods, new materials, and non-traditional new uses for existing materials, equipment, or methods.

National natural science awards and national invention awards are classified according to four levels, and for achievements that are especially significant, special prizes may be bestowed with the approval of the State Council as sought by the State Science and Technology Commission. Certificates of merit, decorations, and financial rewards are granted for each level of awards. Currently, financial rewards for each of the four levels are 20,000, 10,000, 5,000, and 2,000 yuan, respectively, and the financial reward for special prizes is determined separately. According to regulation, the State Science and Technology Commission has unified leadership of the natural science award and invention award work, and also separately establishes commissions for natural science awards and commissions for the evaluation and selection of inventions, and it is responsible for evaluating award items and their levels. From 1979 to the present, there have been 125 national natural science awards approved, and 1,115 national invention awards approved.

According to the "Science and Technology Advancements Award Regulations," awards for scientific and technical advancements are divided into the national level and the provincial (ministries and commissions) level. Those possessing the following conditions may apply for national level science and technology advancement awards:

1. New scientific and technical achievements applied in the building of socialist modernization (including new products, new technologies, new techniques, new materials, new designs, and new biologic varieties), and that are the first in China, advanced within a particular industry, and that have been proven in practice to have major economic results or social results.
2. Creative contributions to the dissemination, sales, or applications of existing scientific and technical achievements that have gained major economic or social results.
3. Achievements that in major project construction, major equipment development, and enterprise technological transformation have used new technologies, have made creative contributions, and have gained major economic or social results.
4. Achievements that in science and technology management and in the work of standardization, measurement, and S&T reporting have made creative contributions and have obtained especially outstanding results.

There are first, second, and third levels for awards, and for those achievements having special significance, achievements may be submitted to the State Council for approval in bestowing special awards. All levels of awards are issued certificates of merit, decorations, and financial rewards. Financial rewards at present for first, second, and third level awards are

15,000, 10,000, and 5,000 yuan, respectively, and the amounts for special prize awards are determined separately. As of this date, 1,761 national level S&T advancements awards have been awarded through the National Science and Technology Advancements Awards Evaluation Commission.

The three national level science and technology awards commissions just described have each established working bodies to be responsible for handling daily affairs.

Efforts at S&T achievement awards in China have developed into the initially constituted system of today that has played a great role in improving the enthusiasm of the many scientists and technicians and workers and farmers for socialist labor and for promoting the development of the cause of science and technology in this country. Future S&T awards will further strengthen legislation, will formulate laws and regulations for S&T awards, and will unify principles; will further smooth regulations, will develop toward multi-mode, multi-channel, and diverse directions, not only for the state, but will also motivate various forces in society regarding awards for science and technology; channels will be created between scientists in China and organizations having influence with international science and technology awards, which will allow S&T awards efforts to attain even greater results.

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SONG JIAN DISCUSSES DEVELOPING RURAL ECONOMY

Beijing KEJI RIBAO in Chinese 22 Feb 87 p 2

[Article by Song Jian: "Let the 'Spark Plans' Blaze Far and Wide"]

[Text] For more than a year, the "Spark Plan" has been ardently supported by all levels of government throughout the country, has been welcomed in the numerous villages everywhere, and has drawn responses and respect from some organizations of the United Nations and of many nations throughout the world. All departments, provinces, autonomous regions, and directly administered municipalities are proceeding from reality and are earnestly organizing their implementations. Work on the "Spark Plan" has had an excellent beginning. In accordance with resolutions of the Central Committee and the State Council, we will carry on with the "Spark Plan" as a fundamental long term policy.

Practically speaking, there has been an uneven execution and development of the "Spark Plan" in all provinces, autonomous regions, and directly administered municipalities throughout the country. The primary leading comrades in many provinces, municipalities, and autonomous regions have been extremely respectful, have personally taken charge of planning, are paying close attention to finances, skilled personnel, and planning implementation, are joining battle with various departments of planning commissions, economic commissions, and science and technology commissions, from which they have opened a better prospective on the situation. On the occasion of this meeting, I hope that everyone will join in learning from areas where the work has been done well, and will learn from their boldness and bravery, and from various feasible measures.

Regarding implementation of the "Spark Plan" from now on, I am using this opportunity to mention some questions of policy that I consider to be rather important, and earnestly and sincerely invite everyone's discussion of them.

I.

The entire prosperity of the Chinese economy depends, on the one hand, on policy, and on the other hand on science. The local and rural economy is even more this way. Our working policies for the countryside have resulted in great accomplishments, acknowledged by all countries of the world. Each year, the Central Committee has proposed guiding principles and policies for the

development of the rural economy as appropriate. That our rural working policies have been successful, I consider to have been mostly due to the word "unleash." The directions represented by the "Spark Plans" and the organization and implementation of the "Spark Plans" should be closely linked with the overall rural policies of the Central Committee and should be one and the same with the spirit of the restructuring of the economic and science and technology systems before they can make the most of their power.

Rural economic development needs the might of science and technology, it needs skilled personnel, and on this point everyone is more or less agreed. All areas have begun to adopt policies and measures to strengthen this aspect, from which results have already been achieved.

However, some recent statistical figures are worth our attention. The average number of technical personnel throughout the countryside is only 6.6 per 10,000; on average, there is 1 agricultural technician for every 7,000 mu of land; there is 1 animal husbandry specialist for every 7,000 head of livestock; there is 1 stock-raising specialist for every 2.3 million mu of grassland; and there is 1 specialist technician for every 160 township enterprises. These numbers show the degree to which we lack rural S&T specialists.

According to statistics, since Liberation, the state has trained 1.04 million agriculturists, and among these 630,000 have left, 260,000 have entered various levels of agricultural administration and agricultural science research organizations, and at present there are only 150,000 people at the front lines. One may also say from this that of every 100 persons so trained, only 14 have remained at the front lines of agriculture. The majority of college graduates who have voluntarily gone to the frontiers are put to work in organizations, many having to change their professions, causing them much worry, which they have even expressed in the newspapers. This problem deserves our fundamental consideration.

As Comrade Deng Xiaoping said to Professor Chen Shengshen [7115 4164 6500] on 3 November 1986, one of the goals of the restructuring of our political system is to strengthen vitality and improve efficiency. Then what can we do about the problems of bringing out the vitality of S&T personnel and of resolving sources for skilled personnel for the countryside and small to mid-size cities?

The State Science and Technology Commission has recently studied this problem, and feels that we should adopt some fundamental measures to further unleash the policies for intellectuals going to the countryside and to small and mid-size cities. For example, we should permit, support, and even encourage a number of scientists and technicians to be released from their existing departmental bonds and to go to small and mid-size cities and to the countryside to take responsibility for and to lead township enterprises, to initiate share-holding enterprises, group enterprises, or individual enterprises. At the same time as they are leading the public in gaining wealth, we should permit their own incomes to increase at a greater rate. If we can create a policy environment where a number of intellectuals dare to go to the countryside, dare to run enterprises in small and mid-size cities, be managers, and be plant directors or senior engineers, then this would result in a large group of entrepreneurs

and businessmen who understand technology. From this can gradually emerge in the countryside and the small and mid-size cities new socialist enterprises of various forms of ownership, either state, group, or individual, that are run by entrepreneurs who understand a particular profession. Because the capacity for responsibility of state finance is limited and because the degree to which profits are retained by state-run enterprises is limited, when many intellectuals stay within research organizations and higher institutions, there is not enough work to be satisfactory, and sometimes there is not any at all, and they cannot make the most of their functions. They are troubled because the policies toward intellectuals cannot be implemented. We should further expand the channels and possibilities for them to fulfill their functions and for them to contribute their intellects to society and to release their powers. If there is just one person to run and invigorate a township enterprise, then dozens and hundreds of farm households will benefit, their incomes will increase, finances will accumulate, local financial income will increase, and the modern material and spiritual cultures will more quickly come into being.

Currently, there are many examples whereby this way of doing things has been successful, both within cities and also the countryside. Restructuring in this country began in the countryside, only after which did we get to the restructuring of the urban economy. If this event could be even more successful in the countryside, it would be certain to have an effect on urban restructuring. A group of intellectuals can lead farmers in enriching themselves, and can enrich themselves as well, all of which is in complete accord with socialist principles.

We should consider doing some experiments as we carry out the "Spark Plan," where not all projects would be arranged by administrative methods, but where a portion would be set aside for open bidding in society. This would encourage intellectuals and professionals to take the lead in running township enterprises, or to contract with township enterprises, to be managers and plant directors, whether for individuals or groups. They would operate autonomously according to the determined output value and profits, and could be supported by investments and credit from the "Spark Plan," and would be left alone to develop on their own.

We have already undertaken a group of "Spark Plan" projects, but can they succeed, can they grow and mature, can they "set the prairie ablaze"? The key is in whether or not they have appropriate leaders. For those projects in danger of ending prematurely, we should consider the methods of contracts and hiring, where we invite capable people to take charge. We should do our utmost to keep the "Spark Plan" projects alive, growing, and maturing, and should avoid the dangers of the past where some S&T projects declined and failed. In addition, since current "Spark Plan" projects are being carried out after evaluation by science and technology commissions at all levels, it is easy to take the old paths of the past, where government (S&T commissions) of all levels would determine projects, appoint a certain person to be in charge, and as a result there are bureaucratic enterprises where the tendency toward the "communal pot" is taken into the township enterprises, of which possibility we should be aware.

Many retired professional and technical people find themselves in the countryside. They have spent the majority of their lives struggling for revolutionary causes and for scientific and technical causes. They have extremely rich work experience and professional knowledge. They love their homes and their countryside, and they are impatient with the poverty of the working people. Now, because of their advanced age they cannot keep up with work in their former positions, but they are very enthusiastic about participating in the "Spark Plan." It is our recommendation that all provinces, municipalities, and autonomous regions give full consideration to the roles of these older comrades, and that they employ various methods to attract them to join in the "Spark Plans." This is also an excellent encouragement and respect for them as people.

II.

The evolution from a natural economy to a socialist planned commodity economy is the key to bringing socialism to the countryside. And training and employing a larger number of entrepreneurs and businessmen who are knowledgeable, courageous and resourceful, talented, and have a spirit of innovation is one of the most important goals of the "Spark Plan."

We must greatly improve labor productivity in the countryside. From a long range point of view, the rural economy will finally change toward the model of industrial commodity production, that is, toward the direction of enterprises. The history of human production over the last several hundred years and the experiences of all nations in the world at present all go to prove this point. This is because it is only through industrialization that we can create the conditions for the great improvement in labor productivity. The particular and disparate farm economy will eventually be replaced by enterprises having a certain degree of economic scale, and that can fully utilize modern equipment. This is the direction toward which we struggle.

It should be acknowledged that as of today we still cannot achieve that point. If the rural economy is to move toward industrialization, in addition to factors having to do with policy, we must also prepare conditions in three aspects: one is skilled personnel, another is funding, and a third is technology and equipment. The most difficult for us are the first two. The accumulation of funds is a slow process. In modern enterprises, per capita technology and equipment is in the hundreds of thousand yuan. According to 1985 statistics, per capita fixed assets for China's industrial staff was at 12,000 yuan, which included the social investments in transportation and energy sources. To equip the rural labor force of nearly 400 million at this level would require 5 trillion yuan, and even reaching one-half of the equipment level of industry throughout the country could not be done in less than 10 or 20 years.

Because of the complexity of the Chinese situation, we must have greater flexibility in policy, and as comrades in our S&T sectors are in the process of carrying out the "Spark Plan," they should be fully aware that they are leading the rural economy in development toward industrialization and toward business, at least for those areas where the problem of having enough to eat and being

warmly dressed has been basically resolved. After more than 30 years of building, national industry has a definite basis, and we have a certain capacity for providing scientific and technical equipment. The problem is that the countryside and localities lack entrepreneurs and business people. They should understand technology or be able to study it, should understand market requirements, and should be bold in serving as leaders of civilian-run small scale enterprises. Through commodity production they should accumulate more funds, should constantly improve the levels of equipment and technology for the enterprises, and within some years hence, should lead these small to medium enterprises gradually into maturity as modern enterprises. If each region could have leaders this bold, the rate of growth for local economies would certainly quicken.

Why is it that we must have so many entrepreneurs? Because it is only under the leadership of entrepreneurs that we can realize the unification of the two factors that are technological advancement and the accumulation of funds. The situation in China today is much better than that of England 200 years ago, Germany and the United States 150 years ago, and Japan 100 years ago. For 30 years now, we have had a relatively abundant industrial base and S&T base, with 16 million skilled S&T personnel. More to the point, we have had in the countryside 120 million intellectual youth who are graduates of elementary school or high school, and this is a tremendous strength. Only by excelling in leadership, enabling them to clearly understand the grand historical mission that is their responsibility, instilling the faith and confidence that this can succeed, and creating an excellent environment for their maturity and growth can there be so many talented and courageous people who will rise up and mature, who will become the mainstay in leading rural people toward modernization, and who will become the heroes of the leadership tide.

This kind of skilled personnel is already beginning to appear. For example, a Hangzhou, Zhejiang, farmer entrepreneur and party member, Comrade Lu Guanqiu [7627 0385 3808], contracted in 1983 to a group owned township-run enterprise--a universal-joint plant, and in only 2 or 3 years time brought this enterprise in a meteoric rise to first place among all other similar firms throughout the country in the seven indices of output, quality, variety, overall labor productivity, rate of return on investment, the rate of tax benefits, and the rate of output value for fixed assets of 10,000 yuan. Their output value rose from the 5.5 million yuan of 1982 to 19 million in 1985, a growth of 3.5 times, and their products have entered the U.S. market in great quantities. Comrade Lu Guanqiu himself had an income of 87,000 yuan in the first year of his contract, 112,000 yuan in the second year, and 250,000 yuan in the third. He has reinvested the majority of these funds and used them for socially beneficial affairs.

There is a youth named Sun Peijie [1327 1014 2638] in Wangxiang Township of Laixi County in Shandong Province, who tirelessly studied cultivation techniques for the Jufeng grape, and he has become the "Grape King" known far and wide. In order to allow his neighbors to escape from poverty and enrich themselves as quickly as possible, he held grape cultivation training classes and transmitted all the secrets to his neighbors. Under his inspired leadership, last year families throughout the village raised Jufeng grapes,

from which they received more than 800,000 yuan to become the first village in the county where the average income per household exceeded 10,000 yuan. Last year he also led more than 300 households in Shandong, Hebei, and Henan in surpassing 10,000 yuan in income.

On the occasion of this meeting we have specially invited the young Wuchang County, Hubei, entrepreneur and Wuhan University specially appointed assistant researcher, Comrade Zhou Jihu [0719 1015 3275]. He studied hard to master more than 10 breeding techniques. He dared to found a business, and organized more than 10 intellectual youth in running a special breeding plant. He put up 50,000 yuan on his own, and in only 2 or 3 years time annual output value has reached millions of yuan with annual profits of tens of thousand yuan. He has helped more than 100 farm households to escape poverty and enrich themselves, and has written in reply to more than 1,400 inquiries from youth all over.

Regarding investments in the "Spark Plan," this year that will be a total of 2.3 billion yuan, one of the smallest figures for investment in national economic construction. But this is no trivial amount. We should pay close attention to using this money to support those young entrepreneurs with courage and ability. This will have major significance for improving the efficiency of utilization of funds, for hastening growth of the "Spark Plans," and for speeding up the future accumulation of funds.

The revolutionary struggle of the Chinese people has been a large school, where we have trained and employed millions of heroes in the long revolutionary struggle. Today, in our process of socialist modernization, developing socialist commodity production is also a large school. At present, those with the greatest potential and capabilities are the younger generation. If all levels of government and all people's organizations, including the science associations, the Communist Youth League, and the Women's Federation, can join their efforts together, we can certainly contribute to the training of an entire generation of young entrepreneurs and business people. And this is especially true for making more of the functions of local and rural technology associations, allowing them to gradually become association organizations of scientific and technical knowledge and also provide services to association members themselves, thereby bringing about the integration of technical and economic activities. Whether or not the modernization of the Chinese countryside can be successful will depend upon whether or not we can train a group of skilled personnel of this sort.

III.

The aim of the "Spark Plan" is to use science and technology to expedite local economies, and especially the development to modernization of the rural economy. What do we mean by a modern economy? What is modern agriculture and industry? Responses to these questions will vary at different times, and will change with the progress of science and technology and of life in society. The situation in China is not the same as elsewhere. We have an enormous population, a vast territory, varied weather conditions, and abundant resources. In principle, only countries that are as large as China have the conditions whereby to develop commodity economies that focus on their own

markets. However, because our first economic steps were taken some one or two hundred years late, we lack the experience of modernization in industry, agriculture, and science and technology. In order to bring about the modernization of China we should study and learn from the experience and knowledge of developed countries and moderately developed countries regarding modern production. This is especially true for the knowledge and experience of general significance to production, exchange, management, and science and technology. This is the goal behind our policy of opening to the outside.

Since the 3d Plenum of the 11th CPC Central Committee and under the guidance of the policy of opening up, China's external S&T affairs have achieved much. However, we should see that there has been insufficient study of paths for development of the rural economy toward foreign countries, nor have there been many comrades who have gone abroad for scientific and technical observation to do systematic studies of agricultural systems and of scientific and technical problems. This is a great drawback. From now on, in the process of carrying out the "Spark Plan" we should enhance efforts in this area. Where finances permit, we should increase rurally appropriate scientific and technical exchanges with developed and moderately developed countries, we should expand contacts between personnel, should send proficient comrades abroad for observation, should interest specialists abroad to come to China for international conferences, should operate joint ventures and contractual joint ventures, etc. If we work in this way there are many advantages: one is that it will aid in changing the isolated state of rural economic thinking by bringing in new techniques and methods from developed and moderately developed nations; another is that we will be bringing in the experience of other nations regarding the development of a rural economy of varied operations, and this is especially true for understanding and learning about pre-production service and post-production processing in the agricultural, animal husbandry, and fishing industries, as well as for the technology, equipment, and organizational methods of marketing, etc.

In summary, opening up is yet another important principle that should be respected during the "Spark Plan." We should fully utilize the excellent international environment initiated by the policy of opening up of the Central Committee. We should learn from the advanced experiences of foreign countries and of domestically advanced areas. We should expand our limits, change our concepts, learn from the experiences of organizing large scale commodity production in the countryside, and learn from the experiences of accumulating funds and improving the levels of technology and equipment under rural economic conditions, etc. This is an important mission for the "Spark Plan."

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REVIEW OF REASONS FOR SUCCESS IN HAIDIAN S&T COMMUNITY

Beijing KEJI RIBAO in Chinese 19 Feb 87 pp 1-2

[Report by Zheng Haining [6774 3189 1337] and Tang Shifen [0781 1102 5358]:
"Praise for the 'Enlightened Grandmothers'"]

[Text] As spring fills the air with warmth, the young trees that are the new industries in the Haidian District of Beijing add a new "annual ring." Seeing these new industrial companies grow like a raging fire, S&T industrialists cannot forget the "enlightened grandmothers" who actively supported and nurtured them under adverse conditions--the Beijing Municipal Science Association and the various levels of leadership and cadre in the Haidian District.

The First Torch of Scientific and Technical Services

One day in the summer of 1980, the Physics Institute of the Chinese Academy of Sciences.

Several middle-aged scientists and technicians are talking privately: how are we to contribute our vital years to the four modernizations effort of our mother country? One who was in charge was named Chen Chunxian [7115 2504 0341], an outstanding scientist in plasma research in this country. They went from discussing the "Silicon Valley" of the United States to the domestic situation for science research: for the new technologies that had come from research that consumed so much state funding, it was such an arduous path from the laboratories into the factories, and from the samples into products. Chen Chunxian felt that they were faced with a brick wall. He once sketched a seam found in the inside, but saw that he could not get through, and it was always like running up against a stone wall. "If we can't get through by burrowing through the wall, let's break through the barriers of the old management system!" So Chen Chunxian and his companions made up their minds.

If we say that Chen Chunxian and his companions were seeds about to sprout, sparks that would spread new technologies, then leading cadre such as Tian Fu [3944 1133] and Sun Hong [1327 3163] of the Beijing Municipal Science Association, and former female director of the Beijing Municipal Science Association Consulting Services and now Beijing Municipal Science Association vice-chair, Zhao Qiqiu [6392 4860 4428] were the sowers and fanners.

With the support of the Beijing Municipal Science Association and the Haidian District government, in October 1980 Chen Chunxian initiated the establishment of the Beijing Plasma Society Advanced Technology Development and Services Unit. This was the first civilian-run S&T service organization in Beijing. From the preparations, determination of goals, and discussions about relevant management rules to receiving the permission to set it up, Zhao Qiqiu was enthusiastically supportive. The Services Unit lacked funds, so Zhao Qiqiu allocated 500 yuan from the municipal science association consulting department. To help the Services Unit get started, Zhao Qiqiu sent out a professional liaison from the municipal science association consulting department. When Zhao Qiqiu was recuperating at home from "(Jia Kang)" illness, she would still often call the Services Unit to inquire about how things were going.

At that time, people had never seen such a new thing, which was criticized constantly as "buying nothing and selling nothing," "up to no good," "undermining the foundations of state-run institutes," and "hucksters of science." Chen Chunxian was investigated, and Zhao Qiqiu came forward to stand up for his rights: "Developing a science and technology consulting service is a good way for scientists and technicians to get into society and to promote the integration of science and technology with production, and this direction is completely correct. That Chen Chunxian is using his spare time to contribute to society is completely appropriate, and we should be giving support!" To obtain that support from higher level leadership departments, Zhao Qiqiu got together with reporters from the Xinhua News Agency, and reported the repression of Chen Chunxian to the Central Committee. Leading comrades of the Central Committee gave full affirmation to the methods of Chen Chunxian, and encouraged him to take the lead in opening up this new situation, and to take this new path that would allow S&T research achievements to be transformed into direct production forces more quickly. With the encouragement of leading comrades of the Central Committee and with the support of the Beijing Municipal Science Association and the Haidian District government, in April 1983 Chen Chunxian opened the first group-owned S&T development organization in the Zhongguancun District--the Beijing Huaxia New Technology Development Institute. Zhao Qiqiu directly participated in discussions concerning the principles, regulations, and management of this institute. The first sprout from the Beijing Municipality civilian-run S&T organizations finally broke through the earth.

Some comrades who opened the Huaxia Institute together with Chen Chunxian recalled that event and quite openly said that "it was Zhao Qiqiu who lit the first torch for Beijing's S&T services."

The "Gardener" Who Worked So Hard at Cultivating

In the spring of 1983, at the home of Hu Dinghuai [5170 1353 3232], person in charge of the Haidian District science and technology commission, it was like a market. The scientists and technicians who streamed through the doors never stopped. After Hu Dinghuai had graduated from Beijing College of Agriculture in 1953, he worked at farms and communes in the Haidian District, going to work

at the district science and technology commission in 1980. Encouraged by the spirit of the restructuring, many scientists and technicians of the Chinese Academy of Sciences developed ardent hopes of transferring the rights to technologies to local enterprises as quickly as possible, while all levels of leadership in the Haidian District were on the trail of actively seeking to change the economic structure of the Haidian District and to bring in new technologies. Hu Dinghual regularly discussed the restructuring with scientists and technicians who had come from the Chinese Academy of Sciences, and to those scientists and technicians who hoped to get involved with associations and the dissemination of new technologies, Hu Dinghual said enthusiastically, "Okay, then come here!"

Hu Dinghual's first convert was Chen Chunxian. After negotiations, at the board of directors of the Huaxia New Technology Development Institute that had been jointly constituted by the Haidian District Industrial Company, the Haidian District Science and Technology Commission, and the Beijing Municipality Science Association, Hu Dinghual became the first chairman of the board of directors. Following upon the "Xinxia," in May 1983 another sprout was born under the concerned nurturing of the Chinese Academy of Sciences and Haidian District leaders, namely the "Ke-Hai New Technology Development Center." Following upon that, a group of companies and centers large and small sprang up like bamboo shoots after a rain. With the establishment of each company the science and technology commission went to look, to talk, to hear reports, and to look into relevant materials, spend 5 or 6 days just in handling paper work. There were only 15 people in the district science and technology commission, the load was heavy for each of them, and to handle things well for these companies and centers, they would often go in on Sundays. Although usually overloaded with work, the science and technology commission cadre never complained.

In the first half of 1985, because of unclear policy boundaries many companies were sued or investigated, and for some the investigations went on for 8 or 9 months. The feeling that "companies are hot" suddenly became "companies stink." Some people would frown or shake their heads just hearing the word 'company.' Some would advocate the "clearing out" of companies without qualification. Would it be "gardeners" for civilian-run S&T organizations or "butchers"? The attitude of the Haidian District government was clear: they wanted to protect. The attitude of the Haidian District science and technology committee was resolute: they wanted to justly and forcefully support.

In June 1985 the Beijing Sitong Group Company prepared to send three key technicians to Japan for discussions with the Sansho Bussan Kabushiki (Product Company) on jointly developing a new Chinese-English typewriter. Leaving the country requires certification by departments of the government. Since that was just the time of the great clearing out, would there be permission to issue this certification? If the certification were not issued, the opportunity for cooperative development with Japan would be lost. The "Sitong" general manager, Wan Runnan [8001 3387 0589], sought out Hu Dinghual in great concern. At that time, Hu Dinghual was both the person in charge of the Haidian District science and technology commission and also concurrently chief of the Office of External Economic Relations, and when he thought about "Sitong" and the benefit

to the state, he thereupon resolved to issue the certification through the science and technology commission and the Office of External Economic Relations: "From the first stage until the present, no problem has ever been found with 'Sitong'." This then allowed "Sitong" and the Japanese party to develop cooperation smoothly. In September 1985, "Sitong" formulated the keyboard design for the MS-2400 Chinese-English typewriter, and in November began development of the applications software. In March 1986 the Japanese party provided samples, and they began on-line debugging of the software. Batch production began in July. On 19 July the China Software Technology Development Center of the State Science and Technology Commission held an evaluation, from which they considered that the design of this machine was advanced and that it was in the forefront of similar products internationally. The MS-2400 Chinese-English typewriter began marketing in 1986, and has become the key product for "Sitong."

For those civilian-run S&T industrialists who have suffered setbacks, Hu Dinghui has always told them to not be discouraged and that during the restructuring they should not take the road of regression. When the Huaxia Institute ran into so many economic issues and got into trouble, the Haidian District science and technology commission did not hold back, but instead gave them a hand. On the one hand, Hu Dinghui supported Chen Chunxian in relying on law to resolve their economic issues, and on the other hand encouraged Chen Chunxian to rally his forces and to join with high technology companies from the United States and Hong Kong to operate the Huaxia Silicon Valley Information Systems Company, Ltd.

It may be said that Hu Dinghui was the "gardener" who so arduously cultivated this new type of industrial hundred flowers garde.

"This Is a Policy Litigation Involving a Respect for Intellectual Labor"

Mao Yuhai [5403 0060 3189], Professor in the Radio Sciences Department of Qinghua University, is concurrently a professor at the "Haihua Center." On one occasion he accepted research responsibility from a certain unit for a "remote control system for laser confrontation maneuvers." The contracting party planned to provide 500,000 yuan, whatever else being needed to be supplemented after successful development.

Although there was a great deal of work involved, a high degree of difficulty, and little time to finish, Professor Mao Yuhai led several professors, engineers, and students in overtime work, where they not only worked in the laboratory but often also lived and ate there; they worked strenuously for 8 months, finally finishing successfully. This project has attained an advanced international level and has won a special prize from relevant departments. But when settling up the bill, the commissioning unit representatives went back on their word, which caused "Haihua" to sustain serious economic losses. Mao Yuhai requested a detailed accounting, but the other party pointed to Mao Yuhai and shouted, "I can see you are not a professor, but only a merchant." Mao Yuhai was so mad he began to tremble and could not speak, and later was overcome with illness.

After the assistant director of the Haidian District science and technology commission, Sun Jinglun [1327 2529 0178], had heard of this affair he went to see Mao Yuhai. Mao Yuhai told him painfully, "It is over. I will make these economic losses up from other projects." But after hearing this, Sun Jinglun said resolutely, "No. We will definitely go to court. This is not just an economic litigation, but rather is a policy litigation involving a respect for knowledge and a respect for intellectual labor." Sun Jinglun supported the comrades of "Haihua" and referred the matter back to the higher authorities of the commissioning unit. As a result, the commissioning unit made up technical development expenses of 250,000 yuan to the "Haihua Center", in addition to which was paid a bonus of 30,000.

In recent years, cadre from the Haidian District science and technology commission have exerted themselves on behalf of civilian-run S&T organizations. They have taken care of worries and resolved difficulties, never taking one cent from these companies, nor ever receiving any trouble from them. Their honesty in performing official duties and complete integrity has won them universal acclaim from entrepreneurs.

"Understanding" Is a Kind of Support

For a certain period of time, civilian-run S&T organizations in many areas were treated unfairly. One would often see where some famous scientists engaged in technical services would be criticized by irresponsible people saying: We do not allow profiteers, we do not allow the driving up of prices for goods, we do not allow stealing or evading taxation. . . all of which was quite upsetting to those scientists and technicians who were so ardently involved in restructuring!

Consequently, why did cadre such as Zhao Qiqiu, Hu Dinghuai, and Sun Jinglun dare to go against the prevailing tide and take risks in protecting and nurturing the civilian S&T industrialists? Hu Dinghuai says that it was just because they "understood" them.

Hu Dinghuai brought up the example of Chen Chunxian for us. When Chen Chunxian opened the Huaxia Institute he was over 40, he was a researcher, had a suite of four rooms, and also a high salary. In running the enterprise, he did not take one extra cent. Why would he do this? Was it not to establish the "Haidian Silicon Valley"? Chen Chunxian has diabetes, but for the sake of the enterprise he would not go into the hospital. His home became an office, laboratory, and classroom; he ate nothing special and wore old clothes. On two occasions, Hu Dinghuai personally saw Chen Chunxian suddenly blanch in the midst of talking, pea-size beads of sweat would roll off, and he would faint. After taking some medicine and drinking some water, he would revive and go on with his work. Hu Dinghuai said, "To see a sight such as this, who could not be moved!"

With a sense of being bound by the old system, a sense of urgency, and a sense of responsibility for an undertaking, this is how scientists and technicians have gotten rid of the "communal pot" and why they have left the "protected courtyards." It was just through such an understanding as this that the

Haidian District science and technology commission could give such complete, wholehearted support to the civilian S&T industrialists, which is why understanding is a kind of support.

And it is also just because of this understanding that when these companies and centers are established or when they celebrate anniversaries, the chief leaders of the Haidian District government will come forward with their congratulations; and it is just because of this understanding that the Haidian District Bank of Commerce and Bank of Agriculture actively make loans to these civilian S&T organizations. The Haidian District Agricultural Bank alone loaned 48 million yuan to these companies last year. In recent years, these companies have generated economic results of more than 500 million yuan and tremendous social results.

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EMERGENCE OF CIVILIAN S&T INDUSTRIALISTS LAUDED

Beijing KEJI RIBAO in Chinese 11 Feb 87 p 1

[Report by Tang Shifen [0781 1102 5358] and Zheng Haining [6774 3189 1337]: "The Appearance of Civilian S&T Industrialists in Great Numbers Is an Important Indication of the Restructuring of the S&T System"]

[Text] On the morning of 10 February, Zeng Xianlin [2582 2009 2651], vice minister of the State Science and Technology Commission, mentioned to the All China Conference on Civilian S&T Industrialists that the appearance of civilian S&T industrialists at the frontlines of science and technology is one indication that the restructuring of the science and technology system has made great progress. S&T industrialists will act as catalysts as science and technology cater to the economy and for the integration of science and technology with production. And they will become the "neutron current" for discharging the potential energy in the science institutes and academies.

Zeng Xianlin was authorized by the State Science and Technology Commission group and Comrade Song Jian to first of all offer their congratulations to those civilian S&T industrialists attending the conference. He said that although the restructuring of the science and technology system has obtained initial results, it is still faced with many problems. The situation in which there is a gulf between research and production has not yet experienced a fundamental change for the better. In order to change this situation, and to hasten the unleashing of science research organizations and the unleashing of scientists and technicians, with the steps of restructuring in which we have focussed on broadened policies and unleashed management, in addition to paying close attention to the formulation and perfection of relevant complementary policies, we must also change a series of obsolete concepts that are not useful in the freeing up of S&T production forces, nor to the integration of S&T with the economy: we must eliminate the idea of protectionism, and establish the concept of equal competition; we must eliminate the idea of grades and ranks in science research organizations, and establish the concept of a commodity economy; we must eliminate the idea of extending a hand to the state for money, and establish the concept of relying upon money earned from science and technology for prosperity; we must eliminate allocated egalitarianism, and establish the concept that more labor gets more compensation; we must eliminate the customary way of doing things in which all tasking is allocated by the state and where under planning people "wait for the rice to fall into the pan by itself," and establish the concept of being concerned about market demand; we must eliminate the thinking that looks down

upon commerce, and establish the concepts of integrating production practices and catering to economic construction.

Zeng Xianlin pointed out that there are many comrades at present who are being bound by the obsolete concepts that look down upon commerce, where many capable people are unwilling to become entrepreneurs. They feel that activities engaged in by civilian science research organizations are all without standards. But after all, what are standards? In evaluating the standards of different scientific and technical work, there should be different criteria. When we are studying and evaluating the standards of integration of science and technology with the economy, it is obvious that we cannot use papers as the primary standard, but rather that we should consider the capacity for economic results and for resolving production technology difficulties as the primary criteria for evaluating standards.

Zeng Xianlin said that there are also people who as soon as they hear that an organization is a civilian S&T organization, they will say "In our unit those people didn't amount to much." This happens to explain that the actual potential in research units is great and that there are many skilled personnel, for as soon as their capabilities are set free they bring great motivation to the economy. Some industrialists can unexpectedly create this kind of result or run an industry that is that good, and if even more comrades could take action, even more could be done. This is the reason we respect civilian S&T organizations.

He said that 'civilian' is one way, but that it is not the only way. We are promoting various, diversified ways of catering to the economy and of shifting technology and knowledge. As long as these things are useful for the integration of science and technology with the economy, that is then the right way, not a wrong way. In addition, we should permit exploration, and permit experiments under the restructuring. If they are successful, we will go that way; if they fail, we will learn from that experience, which will make the restructuring even more complete and mature.

Finally, Zeng Xianlin said, civilian S&T industrialists will break through all obstacles not conducive to the development of production forces, and through their efforts we will establish new entities and build new systems during the restructuring, and we will build brand new science research, production, and operations operational mechanisms.

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EFFORTS DESCRIBED FOR INVIGORATING ELECTROMECHANICS

Beijing ZHONGGUO JIXIE BAO in Chinese 10 Feb 87 p 3

[Report by Li Jiakang [2621 0857 1660], Director, Shanghai Municipal Bureau of Electromechanics Industrial Management: "To Revitalize the Shanghai Electromechanics Industry Through Reliance on Scientific and Technical Advances"]

[Text] Through 36 years of growth since the founding of the PRC, and especially after the transformations and development during the Sixth 5-Year Plan, the electromechanics industry in Shanghai has preliminarily established a manufacturing industrial base that is complete in disciplines, has a good situation for cooperation, has a definite level of science and technology, and that has rather high economic results. It has begun to be responsible for the manufacturing of some of the heavy, large, and sophisticated products needed in Shanghai and by the nation at large, and provides a great deal of rather advanced technology and equipment for all sectors of the national economy.

The Shanghai electromechanical industrial system is presently composed of the 11 specialties that are: machine tools, electrical machinery, electrical appliances, vehicles and tractors, petrochemical general use machinery, metallurgy and mining machinery, light industrial machinery, power station sets, standard parts, bearings, and hydraulic components, as well as of 420 factories such as the Shanghai Heavy Equipment and Machinery Plant, the Shanghai Machine Tool Plant, the Shanghai Diesel Engine Plant, and the Shanghai Electric Machinery Plant. In addition, there are 16 science research institutes and academies such as the Shanghai Research Institute of Electromechanical Design and the Shanghai Institute of Mechanized Manufacturing Techniques and 10 enterprises that are joint ventures with foreign commercial interests. All together, there is a staff of 350,000 people. In 1986, overall industrial output value reached 7.658 billion yuan. Income from sales was 7.9 billion yuan and there was a realized tax profit of 2.3 billion yuan, which was foremost among similar industries throughout the country.

Practice has shown that the inevitable way in which transformation and invigoration of the Shanghai electromechanics industry will come about is through reliance on scientific and technical progress.

A Review of Technological Progress of the Shanghai Electromechanical Industry During the Sixth 5 Year Plan

During the period of the Sixth 5-Year Plan, under the leadership and help of the higher authorities, scientific and technical growth of the Shanghai electromechanics industry exhibited the following five changes: one, product development efforts changed from the former sole reliance on their own strength to both full realization of that self-strength and to active importation of foreign advanced technology; two, improvements in product quality changed from sole concern for the manufacturing quality of old products to the current strengthening of product manufacturing control management, as well as to concern for product renewal and replacement, which is fundamentally improving the level of product quality; three, implementing product standards changed from the former sole reliance on organizing production in accordance with domestic standards to the organizing of production through adopting international standards or advanced foreign standards; four, product upgrading has changed from the renewal of a particular product to a progressive development toward renewal of whole series of products; five, the understanding of the concept of technology development has changed from just concern for the development of material goods to concurrent attention to the development and fostering of skilled personnel. During the period of the Sixth 5-Year Plan, the growth of the Shanghai electromechanics industrial science and technology had the following specific manifestations:

The level of industrial products improved greatly. During the Sixth 5-Year Plan the overall system successfully test produced new products in 1,046 series, 3,882 types, and 22,217 specifications. Among these, 73.5 percent of the products reached international levels of the 1970's, and 5.8 percent reached international standards of the 1980's. Equipment such as the Electromechanical Company's Y-series asynchronous generator and derived series of generators, the 110,000 volt and 220,000 volt SF6 totally-closed combination electrical apparatus from the Huatong Switch Plant, the H160 numerically controlled cylindrical grinding machine from the Shanghai Machine Tool Plant, and the 5-meter tunneler set from the Shanghai Heavy Machinery and Equipment Plant have all reached the international levels of the 1970's and 80's. By the end of 1985, the overall output value for products that reached the levels of the 1970's and 80's was 2.204 billion yuan, which was 30.4 percent of the overall industrial gross output value for that year.

We actively adopted international standards. By the end of 1985, there were 585 products that had adopted international standards or advanced foreign standards, which was 32.5 percent of the total number that had adopted international standards throughout the original Ministry of the Machine Building Industry. The Shanghai Standard Parts Plant has transformed the American ANSI standards and the West German DIN standards into enterprise standards, consequently allowing products from a significant group of enterprises to reach the requirements of the relevant standards from the United States and West Germany, which has strengthened the foreign exchange generating capacity of products through export. In recent years, the foreign exchange generated by the Standard Parts Plant through exports each year has exceeded \$10 million.

We have assimilated foreign advanced technology, improving the level of enterprise technology. Since 1979, the overall system has imported 191 items of advanced technology, among which 103 were items of soft technologies, 68 were items of hard technologies, 2 were technology consulting, and 18 were other technologies. Three large power equipment plants, the Electric Generator Plant, the Steam Turbine Plant, and the Boiler Plant, imported 300,000 kw--600,000 kw complete sets of thermal electric equipment and technology from the American Westinghouse Company; the large scale cast and forged parts technology imported by the Shanghai Heavy Machinery and Equipment Plant from Japan and the model 2030 cold rolling mill manufactured in cooperation with the West German (XMK) Company have all brought about improvements in the levels of technology for these enterprises.

In initiating scientific research problem solving, we have promoted product development. During the period of the Sixth 5-Year Plan a total of 991 science research projects were finished, 551 of which have been disseminated. The "small scale instrument lathe modular technology research" developed cooperatively by the Shanghai Machine Tool Institute, the Instrument and Meter Machine Tool Plant, and the Machine Tool Plant No 12 has achieved very good results. It can use 54 basic modules that can be combined into 202 different products, and by adding another 45 function modules all requirements can be met, and it is a leading standard among similar domestic industries.

We broadly initiated problem solving for techniques in technological innovation, which has quickened the technological transformation of enterprises. In all, the overall system has completed 1,150 technique problem solving projects, among which 750 have been disseminated; more than 38,500 public technological innovation projects have been completed, which is approximately 20 percent of the total number of public technological innovation projects in Shanghai. The pipeline assembly line for window model air conditioners from the Shanghai Air Conditioner Plant is a loop pipeline having 48 processes. It uses advanced techniques, can accurately measure and add flourine, can dehumidify, and is of a high standard among similar domestic industries. It is already at a preliminary scale in strengthening the construction of a science research base. During the Sixth 5-Year Plan there was an overall addition of 16 science industries affiliated with bureaus or companies, and an addition of 39.2 percent for scientists and technicians; fixed assets increased by 82.8 percent.

During the Sixth 5-Year Plan the Shanghai electromechanics industry closely relied upon advances in science and technology to promote the growth of production and the improvement of economic results. Throughout the period of the Sixth 5-Year plan aside from the readjustment during one year (1981), in the latter 4 years the annual industrial gross output value increased by 11 percent, which was an average increase in taxes on profits of 13 percent. The Shanghai electromechanics industry is advancing, improving, and growing, but we should also notice that the situation regarding the Shanghai electromechanics industry can still not satisfy the demands of the growth of the national economy, and in comparison with advanced international levels, whether in quantity or quality and product types, there are still great gaps, especially in the capacity for organizing sets of equipment and the capacity for expanding exports. These things require us to work at catching up during the period of the Seventh 5-Year Plan.

Science and Technology Directions for Growth and Tasking for the Shanghai Electromechanics Industry During the Seventh 5-Year Plan

According to the requirements of the overall goals for China's national economic growth and market demands, the situation regarding the integration of Shanghai's electromechanics industry is such that by 1990 the goals for scientific and technical growth of this industry in Shanghai will be: "to aim at advanced international standards, have an eye toward the two markets, struggle for 5 years, pledge to strive for 4,000, and to struggle to be the vanguard for electromechanics industries throughout the nation." By "pledge to strive for 4,000" is meant that by 1990 the electromechanics industry in Shanghai will have 250 leading products (basic series), 3,000 primary products for which the level of technology is basically that for industrially developed countries of the world at the end of the 1970's or of the early 1980's; we will initiate problem solving projects in 500 key technologies; we will establish model plant sites for technological transformation, which will develop 150 electrically and mechanically integrated instruments.

In order to realize this goal, we must uphold the four basic principles, that is, to uphold the principles of restructuring, opening up, invigoration, and increasing production while economizing.

First of all, in the spirit of restructuring we should actively develop lateral S&T economic associations. With a new technology product as the key product, we should develop relations with all higher institutions and science research units, thereby forming diverse production/research associations and enterprise groups to constitute systems that are high quality and specialized unifications of research and production.

Then, we must continue to implement our open-door policy, adopting various forms such as technology importation, cooperative production, and joint ventures to actively bring in advanced foreign technology and funding. At the same time, we should hasten our absorption and assimilation of imported technology, and strive to realize the nationalization of imported products. And we should learn and master design, experimentation, and production of technology such as that from large scale sets of equipment like the model "2030" cold rolling mill and the 300,000-600,000 kw thermal power equipment, both from phase 2 of the Baotian Iron and Steel Works project.

Third, we should gather together our manpower and materials, and emphasize technological transformation. During the period of the Seventh 5-Year Plan we should pay attention to the technological transformation of major industries such as power generation equipment, high voltage transformer equipment, vehicles, tractors, and machine tools in order to ensure the continued, stable, and coordinated development of the Shanghai electromechanics industry.

Fourth, we should make great efforts at the training of skilled personnel. We should adopt various means by which to strengthen the fostering of skilled personnel such that by 1990 the overall number of skilled specialist personnel who are graduates of polytechnical schools or higher will have increased from the 29,000 personnel of 1985 to 70,000; that among technical workers, those at the middle levels will be 50 percent and more of the total number of staff, and those at the higher levels will be 80 percent of the total staff. At the same time, we will hasten the fostering and improvement of technology staff and management cadre of all sorts to gradually establish a science and technology contingent and a management contingent that can independently design, test, and manufacture.

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CONTRIBUTIONS OF MINERAL DEPOSIT INSTITUTE REVIEWED

Beijing KEJI RIBAO in Chinese 30 Mar 87 p 2

[Report by Feng Zai [7458 0375] and Chen Hui [7115 6540]: "A Research Center to Explore the Secrets of the Distribution of Geologic Ore Deposits"]

[Text] Not long ago was the 30th anniversary of the founding of the Zhengzhi Ore Deposit Geologic Institute, and we went to visit this national research center for mineral deposit geology. This institute has raised the level of theory on mineral deposit geology on behalf of the growth of China's mineral deposit geological efforts, which has played a major role in hastening the modernization of mineral deposit geologic research.

The institute director, Yu Zhihong [0060 1807 7703], told us that the Ore Deposit Geologic Institute was founded in 1956, primarily to study the theory of ore formation, the conditions of mineral formation, indications for finding ores, mineral forecasting, and relevant new technologies and methods, as well as the function of these things in mineral prospecting.

At present, this institute has more than 50 high-level researchers and more than 100 middle-level researchers, it has founded 18 modern laboratories, and can undertake research in such disciplines as metallic ores, nonmetallic ores, zone mineralization laws, minerals, rocks, earth chemistry, earth physics, remote-sensing geology, mathematic geology, lake geology, and fluid envelopes. It can also undertake comprehensive mineral deposit geologic research at high levels in multiple disciplines.

For 30 years, the Ore Deposit Geologic Institute has participated in many well-known ore deposit surveys, evaluations, and research in China, and the footprints of scientists and technicians from this institute are all over the myriad mountains and streams of our country. The Hua'nian rare rare-earth element crust of weathering mineral deposit, the Baiyun'ebo [Nei Mongol] superlarge niobium mineral deposit, the discovery of China's first diamond primary deposit, as well as the problem of the accompanying metals in the copper-rich metallic deposits in the middle and lower reaches of the Chang Jiang, and studies on aspects of substance composition of the Panxi vanadium titanium magnetite deposit, all of which brought together the efforts and wisdom of the scientists and technicians at the Ore Deposit Institute. Especially in the last few years, in the vast open regions that are the middle

and lower reaches of the Chang Jiang, Nanling, Xinjiang, the Qingzang Plateau, Chuanxi, Sanjiang, and Qinling, multiple discipline, hierarchical research has been done on mineral resources such as iron, copper, nonferrous metals, sylvite, clay, gems, and rare rare-earth minerals. They have undertaken more than 20 major projects and research tasking on 50 to 60 topics. Over the past few years, they have turned over hundreds of research achievements to the state, among which 14 have won awards from the National Science Association, 2 have won state natural science awards, 1 was awarded a third prize for state inventions, and 38 have won second, third, and fourth prizes from the Ministry of Geology and Mineral Resources.

During the period of the 7th 5-Year Plan, the Ore Deposit Geologic Institute is undertaking and participating in four ministry-level S&T problem-solving projects and more than 50 research topics for ministry institutes. Among these are researches on the laws of mineral formation in Xinjiang, Sanjiang, and north China regions, and on preferred target regions, all of which will lay the foundation for a base of new mineral resources in China.

In reviewing the course of the last 30 years for the Ore Deposit Geologic Institute, Yu Zhihong sighed with emotion, "We cannot be satisfied with the achievements we have already made, nor dare we permit ourselves any slack in the heavy responsibilities of the institute." He said that the existing value of the institute lies in the role of its achievements, and the truth of the spirit of the resolutions by the Central Committee regarding the restructuring of the S&T system is to promote science and technology as a service in our socialist modernization.

In recent years, this institute has broadly developed lateral S&T development, and has provided technical consulting services for all relevant departments throughout the country and for local township enterprises; it has also used the method of technology shareholding to establish operations companies with localities, which increases the lateral income for the institute.

When speaking of future growth of the institute, Yu Zhihong said that if there are no people of a high level we cannot speak of accomplishing high-level tasking. At present, even though we have a large group of older and middle-aged key personnel, we must strive to train younger key personnel, and must adopt powerful measures to improve the quality of the younger key personnel. The maturing of younger key personnel is a requirement for the growth of geology in China, and is the hope for the Ore Deposit Geologic Institute.

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DISCOVERY MADE IN SUPERCONDUCTOR RESEARCH

Beijing KEJI RIBAO in Chinese 29 Mar 87 p 1

[Report by Zhang Zhaojun [1728 0340 6511] and Tong Yu [1749 1342]: "Jilin University Superconductor Research Discovers Paramagnetic-Diamagnetic Temperature-Dependent Alternating Changes"]

[Text] 28 March, Changchun--In its superconductor research, Jilin University has been the first to discover the strange phenomenon where magnetic susceptibility changes as temperature changes. Near the transition temperature for superconductors, as temperature changes there is an alternation of paramagnetism and diamagnetism. This discovery has major significance for uncovering the superconducting mechanism in new superconducting materials.

This achievement was observed at 4 am 28 March by research personnel at the Jilin University Department of Physics Solid State Physics Laboratory and the Applied Magnetics Laboratory after 14 days of problem-solving efforts.

When samples were gradually cooled from room temperature, the samples exhibited paramagnetism. After reaching the greatest value for that at 137 K, the value changed to zero by 118 K. Then, a high diamagnetism value appeared at 100 K, after which it rapidly decreased, becoming zero at 83 K. With further cooling, the second peak value for paramagnetism was reached at 80 K, after which it weakened to zero and the diamagnetism once again began to strengthen. This phenomenon is closely related to many phenomena appearing in research on ABO_3 perovskite-structure rare earth oxides concerned with high-voltage rare earth solid-state physics developed over many years by researchers.

Professors Yu Ruihuang [0151 3843 3874] and Xu Xurong [1776 0650 8833] of the Chinese Academy of Sciences Scientific Council believe that the appearance of this phenomenon is a contribution to uncovering the mysteries of the superconducting mechanisms of new types of rare earth oxide superconductors. Currently, researchers at Jilin University are intensifying their studies to strive to propose as quickly as possible unique explanatory theories for superconducting mechanisms.

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WORLD'S FIRST PLASTIC BATTERY DEVELOPED

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 21 Apr 87 p 4

[Text] China has made a major breakthrough in research on conducting polymers. A battery using a new type of conducting high-polymer polyphenylene amides as a replacement for the metallic electrodes has been successfully produced in the city of Yangzhou, Jiangsu Province. Evaluations by famous scientists in this country hold that this achievement is not only at the forefront domestically, but is also among top ranks worldwide. Its standard has approached the stage of actual application, it has a broad future for applications, and the plastic battery will be available within a very short time.

According to a report in KEJI RIBAO, this conducting polymer material uses a high polymer compound as its base, into which is doped certain ions, by which it becomes a material with conducting abilities. In this way, a polymer can conduct just like metal, which was first discovered 10 years ago by the American, Prof Michael (Diami). But as of this date, research into actual applications has yet to obtain any advance of a breakthrough nature. After more than 3 years of arduous exploration, the middle-aged Prof Mu Shaolin [4476 4801 2651] of the Yangzhou Shifan Academy in China has successfully developed a new type of conducting high-polymer polyamine with the support and direction of Prof Qian Renyuan [6929 0086 0337], a well-known polymer physical chemist in China. Mu has also successfully used this to replace the electrodes in storage batteries, with which he has made more than 1,000 experiments on electrical discharge. Performance has been stable and operation has been reliable, so the technique is going into production.

Prof Qian Renyuan, internationally known polymer physicist and member of the Scientific Council of the China Academy of Sciences, explained that research on conducting polymer materials has only been going on in the world for 10 years, and so research into its theory and practical applications is still at the exploratory stages. The successful development by China regarding the use of conducting high-polymer polyphenylene amides in place of metallic electrodes is an achievement that is a major breakthrough, and that has great significance. Use of this new conducting plastic as battery electrodes will mean light weight, no corrosion, the ability to be repeatedly recharged and discharged, and a low price. It has a broad applications future, and has paved the way for China to open up applications research into conducting polymers technology.

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DEVELOPMENTS IN GAS TURBINE APPLICATIONS NOTED

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 23 Feb 87 p 3

[Report by Huang Bin [7806 2430]: "Promoting the Land Use of Aircraft Engines, and Developing Two Markets"]

[Text] The Ministry of Aeronautics is implementing the policy regarding the integration of the military and the civilian, and since the mid-seventies has been actively improving and updating its aviation gas turbines, the results of which have already begun to be apparent for their use in non-aviation fields. At present, there have been 83 units in 51 sets of light duty gas turbine engines supplied by the Ministry of Aeronautics for domestic energy resources and transformation, and to serve the transformation of the national economy, which have been distributed among 13 provinces, autonomous regions, and municipalities in China. In recent years, light-duty gas turbine installations have accumulated 250,000 hours of operation time, where the longest operational time for a single engine has exceeded 13,800 hours.

The light-duty gas turbines transformed from aircraft gas turbines are advanced energy conserving power units that can be widely used for oil field electrical generation, heating, water flooding, pumping gases, coal mine fire extinguishing, industrial drivers, and as power for naval vessels. Practice has shown that by using light duty gas turbines for power, there is less expenditure, great effects, and outstanding economic and social results. Since the WP-68 gas turbine thermoelectric and power group manufactured by the Liming Machinery Company of the Ministry of Aeronautics was turned over to the Daqing oilfield in October 1984 for use in operations, it has generated 55.93 million kwh over the 2-year period, and has generated more than 153,000 tons of steam; another two sets of the same model gas turbine water flooding pump group went into operation in 1986, during which year they flooded more than 1.3 million tons of water, and provided nearly 300,000 tons of water at 150 degrees Centigrade, which have made great contributions to the stable and increased production of Daqing crude oil. In recent years, the Nanfang Motive Power Machinery Company has changed the aviation engine into a ground power source, used at six oilfields like Zhongyuan and Changqing, and also at the Lhasa Thermoelectric Plant, where it has generated a total of 132 million kwh.

At the same time as it is serving domestic construction, the Ministry of Aeronautics is also expanding its fields of development, actively seeking

partners for cooperation internationally. In August of last year, China and the United States signed agreements to develop the FT-8 gas turbine, which is an advanced version of the newest model aviation engine produced by the American Pratt & Whitney Company. Based on the principals of "joint design, joint production, joint marketing, and joint development," both sides will build the first unit over the next 3 years as a product of a contemporary level. This will allow China's gas turbine development and applications to enter a new stage, and it is predicted that there are excellent prospects for earning foreign exchange.

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INTERVIEW WITH PLANETARY WAVE KINETICS THEORETICIAN

Beijing RENMIN RIBAO in Chinese 12 Apr 87 p 4

[Report by Zhou Qing [0719 1987]: "Huang Ronghui and His Planetary Wave Kinetics Research"]

[Excerpts] Huang Ronghui [7806 2837 6540], a researcher at the Atmospheric Physics Institute of the Chinese Academy of Sciences and director of Laboratory No 5, was born in 1942 in Huian, Fujian Province. He graduated from the Department of Earth Physics at Beijing University in 1965, and the same year entered the Chinese Academy of Sciences as a graduate student; in 1983, he obtained a Ph. D. in physics at Tokyo University, has published more than 40 papers, has attended six international academic conferences, and has won 2 domestic prizes for his research achievements.

Above the "global village" in which we live, there is what atmospheric physicists call the quasiregular atmospheric wave motion of planetary waves. In recent years, the droughts and floods, extreme cold, and cruel heat throughout the world have been unusually closely related to the distribution of these atmospheric wave motions. Research on this has become a topic at the forefront of contemporary international atmospheric sciences research areas.

A child of Chinese peasants, Huang Ronghui was the first of his family to turn his eyes to the heavens and away from the earth. Today, as world atmospheric abnormalities cause the average person to begin to notice the "El Nino" effect over the Pacific Ocean and the plateau heat sources on the continent, Huang Ronghui has done developmental explorations of the atmospheric planetary wave motion mechanisms. He points out that we must divide the atmosphere into several sections along vertical lines before we can accurately describe this kind of wave motion, and he was the first in the world to divide the atmosphere into 34 levels for studying quasiconstant planetary waves.

His accomplishment drew the respect of those in similar fields internationally, and that was in 1981. In 1986 he used a computer to analyze hundreds of million pieces of data, for which task he wrote a program in tens of thousand lines of code, published more than 20 papers, consequently disseminating the physical factors involved in the quasiconstant planetary waves, and their laws of propagation, as well as a more detailed explanation of their abnormalities. In addition, he discovered two waveguides that exist

in three dimensional space for these atmospheric waves, which propagate through two channels. This has provided a definite basis for long-range weather forecasting over months and seasons, and has provided a new perspective on clarifying some of the secrets of meteorology.

There are no national boundaries in science. The accomplishments of this Chinese have elicited a string of responses from international atmospheric sciences circles:

"I am currently writing a review article and would very much like to quote the results from your article." This letter came from MIT in the United States.

"After my paper had been written, [I found that] Dr Huang of China had already published his research results on three-dimensional hierarchical modeling, and my results are quite similar to [his]." So stated a well-known British atmospheric kineticist when quoting the results of Huang Ronghui in a paper...

His native country has presented Huang Ronghui with even greater acclaim: his results were awarded the first prize for scientific advances in 1985 by the Chinese Academy of Sciences.

Changes in the quasiconstant planetary waves are slow, the wavelength is greater than 10,000 km, even longer than the diameter of the earth (6,400 km), and this is the key kinetic problem in long-range weather forecasting of 2 weeks and longer, and for short-term weather changes. In doing this kind of theoretical research, one must begin by analyzing tremendous amounts of observation data. To propose a new opinion or theory in this field, even though a country trains quality scientists, there still must be an enormous expenditure of energy. Nor did Huang Ronghui have any shortcuts.

In 1979 he was sent to Japan for advanced study, and for 2 years he worked 14 hours and more a day, sometimes working all night in the laboratory.

At times, Huang Ronghui can be somewhat "absentminded," so he really has the air of a Chinese intellectual about him. Because of his accomplishments in planetary wave kinetics research, when he was studying in Japan, the director of the Japanese Meteorological Society at that time would often try to persuade him to stay in Japan for research, and also offered him some living expenses for the period he was in Japan, but he would not agree and returned to China as scheduled. A meteorologist at the U.S. Atmospheric Research Center wanted to provide him with a very generous salary to persuade him to go to the United States to work, but he graciously declined, saying "When my country needs me to go to the United States for cooperative research, then I will go." And not long ago, a university abroad also wanted to hire for more than \$20,000 a year, but he would not agree to this either. He told this reporter, "A scientist such as myself has his own country, and my job is in the country that gave me birth and raised me--China."

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DETERMINATION OF GROSS- β RADIOACTIVITY IN WATER OF CHANGJIANG RIVER AND SEAWATER NEAR ITS ENTRANCE TO SEA

Beijing HAIYANG YU HUZAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 18 No 2, Mar 87 pp 151-153

[English abstract of article by Kang Xinglun [1660 5281 0243], et al., of the Institute of Oceanology, Chinese Academy of Sciences, Qingdao]

[Text] Gross- β radioactivity was determined with the barium chloride ferri-ammonium sulfate method. It has been discovered that gross- β radioactivity in water of the Changjiang River is lower than that of seawater. It ranges from 0.88 to 1.40 pCi/L, with a mean value of 1.13 pCi/L. Gross- β radioactivity in seawater ranges from 1.73 to 3.32 pCi/L, with a mean value of 2.23 pCi/L. It is shown by a regression computation that in the area observed the correlation coefficient between gross- β and chlorinity is 0.916. The regression equation is:

$$\beta = 1.18 + 0.075C1.$$

The water of the Changjiang River dilutes seawater in gross- β concentration. (Paper received 12 Apr 85.)

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FLOW INJECTION ANALYSIS OF IRON IN MARINE SEDIMENTS

Beijing HAIYANG YU HUAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 18 No 2, Mar 87 pp 156-161

[English abstract of article by Yuan Youxian [5913 2589 2009] of the Yellow Sea Fisheries Research Institute, Chinese Academy of Fisheries Sciences, Qingdao]

[Text] In this paper, a flow injection analysis (FIA) using the iron (II)-bathophenanthroline-Triton X-100 system is established. The method is simple and very selective. One hundred determinations can be run in an hour, with a 50 μ l sample required for each determination. The linear ranges for the calibration curve and detection limit are 0.5 - 4.0 ppm Fe and 0.02 ppm Fe respectively. The variation coefficient for 3.0 ppm Fe solution has been found to be 2.0 percent. This method has been applied to the rapid determination of iron in marine sediments with satisfactory results and it can be applied to determine microamounts of iron in other samples as well. (Paper received 6 Jul 85.)

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GEOMORPHOLOGY AND SEDIMENTATION IN COASTAL ZONES FROM CHENGSHANJIAO TO SHIDAO, RONGCHENG, SHANDONG PROVINCE

Beijing HAIYANG YU HUZAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 18 No 2, Mar 87 pp 162-172

[English abstract of article by Li Congxian [2621 1783 0341], et al., of Tongji University, Shanghai; Gao Manna [7559 2581 1226], et al., of Shandong College of Oceanology, Qingdao]

[Text] The coasts from Chengshanjiao to Shidao are located in east Shandong Peninsula with geomorphological and sedimentary characteristics which may be a type of the irregular coastal development in bedrock of the Shandong Peninsula.

The coasts in the area studied can be further subdivided into four types: erosion coast, erosion and deposition coast, graded coast in bay and coast with large tombolo. Differences in the coastal type directly influence the source and amount of sediments transported along the coast, the variety of coastal sand bodies and the development stages of the barrier-lagoon systems. The barrier-lagoon depositional systems are more important to coastal sedimentary units, distributed mainly in the Rongcheng, Sanggou and Shidao bays and in the tombolo areas of Moye and Chudao islands. A barrier-lagoon depositional system consists of three subdivisions: barrier bar, bay in front of the bar and lagoon at the back of the bar. The distribution of sediments in bays is controlled by hydrodynamics and postglacial sealevel fluctuations. In nearshore zones of the bays, clay and sandy clay are usually found, which may be caused by circulated tidal currents. The heavy minerals in the bays are the same as those in adjacent lagoons and barriers, but the percentages are different, indicating the hydrodynamic variety in these sedimentary units. In bays with salinity of 32-33 per-thousandth, the microfauna are characterized by neritic environment. The grain size distribution and heavy mineral assemblage in the barrier are controlled by bedrock. In the northern part of the studied coast where granites are distributed, the bars consist of coarse sands and fine gravels. Epidotes and hornblende predominate in the heavy minerals. In the middle area where metamorphic rocks outcrop, the barrier bars are composed of medium and coarse sands and the percentage of hornblende may be above 60 percent. In the southern area where the sienites, outcrop, the bars consist mainly of medium sands, while the heavy mineral assemblage is characterized

by zircon, titanioferrite and magnetite. The medium- and large-scale cross-beddings with low angles dipping seaward appear in the bars in which heavy minerals, shell debris, gravels and inverse graded bedding are common. The beddings in the bar crest show an arch shape or cross in a pyramid shape. In the bar lee the parallel beddings and landward dipping stratifications with high angles appear. The lagoons in the studied area can be divided into two types: enclosed and semi-enclosed. The mud deposits increase and salinity decreases as the lagoon becomes enclosed. In some semi-enclosed lagoons reworked by humans, however, the salinity can be up to 37.19-43.24 per thousandth. The hyperhaline and hypohaline waters in the lagoons directly influence microfossil assemblages that are characterized by small amounts of microfossils, low species diversity and an abundance of euryhaline elements.

The tectorium along the coasts of Rongcheng contains only one bed with marine fossils which is underlain by a weathered crust and composed of transgressive and regressive sequences. The barrier-lagoon sedimentary systems are present in a regressive sequence, belonging to the regressive type. Based on the data of borings, the lagoon deposits are underlain by bay-neritic facies sediment and further divided into bay-lagoon, semi-enclosed lagoon and enclosed lagoon units, thereby distinguishing the bay-lagoon, semi-enclosed lagoon and enclosed lagoon. The tombolo-lagoon behind Moye and Chudao islands has been formed and lagoon sediments preserved. The tombolo development behind large islands may be one of the ways that barrier-lagoon systems are formed. (Paper received 4 Jul 83.)

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